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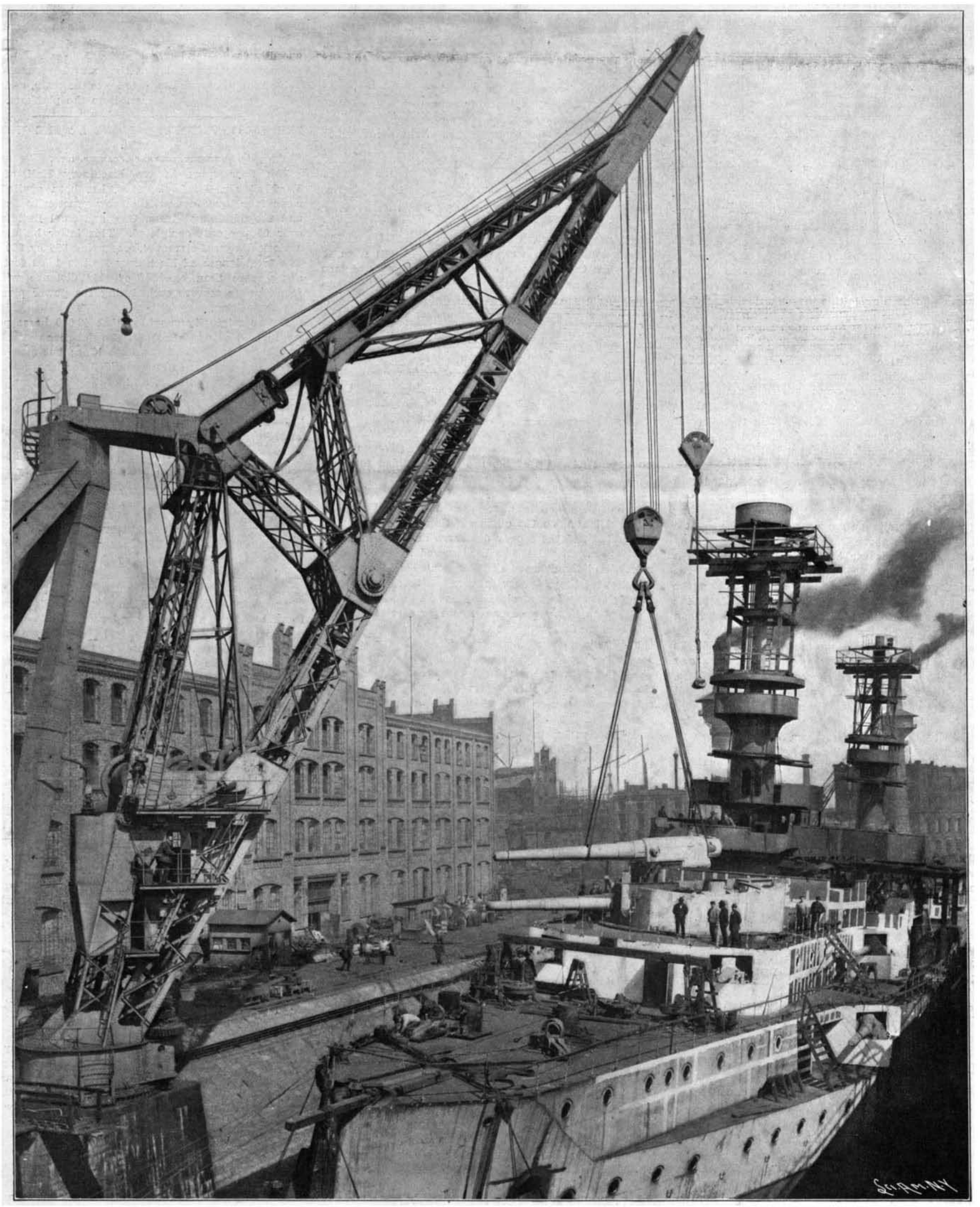

THE GREAT 150-TON DOCK CRANE AT HAMBURG, GERMANY, MOUNTING A 9.45-INCH GUN ON THE "KAISER KARL."—[See page 239.]

Maximum lift, 145 feet. Speed with 150-ton load, 5 feet per minute; with 10-ton load, 40 feet per minute.

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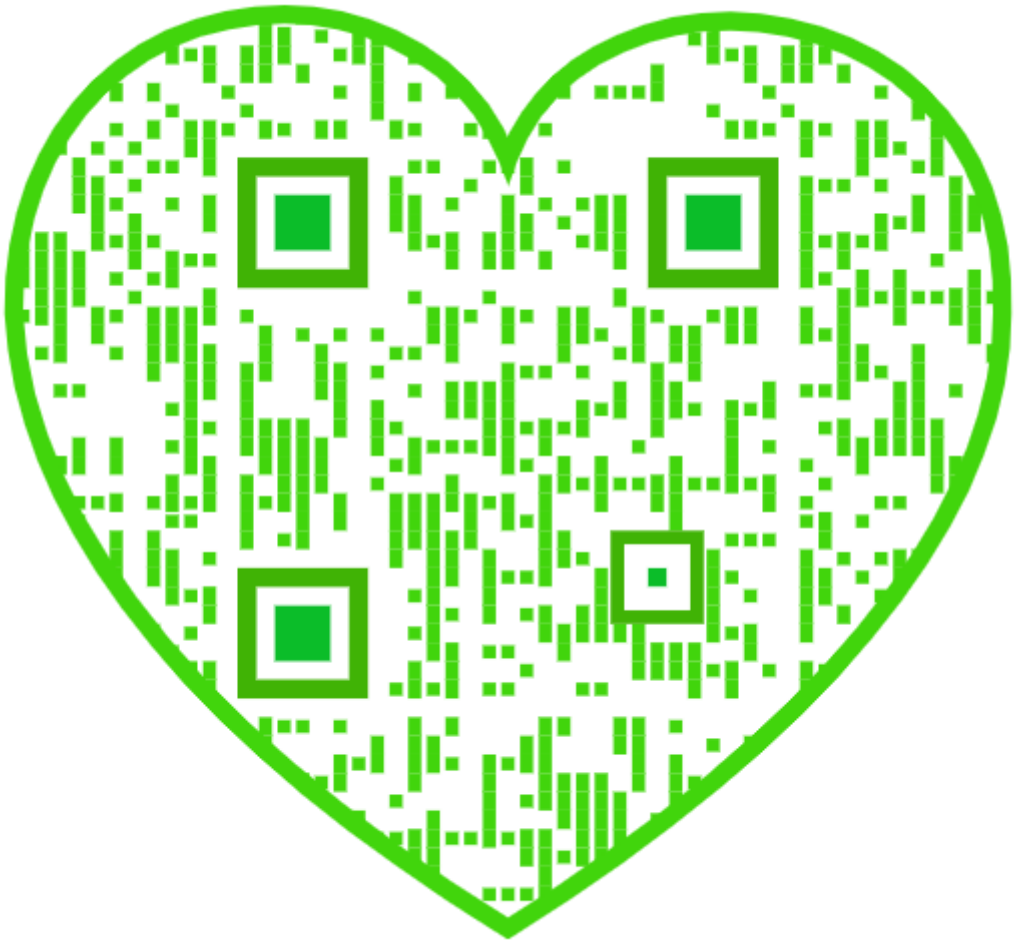

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NEW YORK, SATURDAY, OCTOBER 3, 1903.

The editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE FUTURE WATER SUPPLY OF NEW YORK CITY.

The expert commission which was appointed to examine into the question of the available sources of water supply for New York city, and the best methods of conserving and utilizing the same, has made a preliminary report to the Board of Estimate. The commission states that in spite of the decrease in the waste of water by consumers in New York, it is necessary, in view of the rapid growth of the city, that steps be taken immediately to secure a larger supply. According to the preliminary estimate of the eminent engineers who have made this investigation, immediate provision should be made for storing and introducing into the city an additional daily supply of 200,000,000 gallons, to be delivered by gravity at an elevation of 300 feet above mean tide level. The cost of this portion of the scheme, including the necessary dams and aqueduct, will be $50,000,000. Acting on the advice of the Corporation Counsel, the investigation was confined entirely to those streams of water which lie within the State of New York, and the commission discovered that there are three available sources of supply. First, from certain of the eastern tributaries of the Hudson; secondly, from a portion of the eastern tributaries combined with the headwaters of Esopus Creek on the easterly side of the Catskill Mountains; and, thirdly, by pumping and filtering water taken from the Hudson River, at a point a few miles above Poughkeepsie. Although any one of these sources can be developed to maintain a constant supply of 500,000,000 gallons daily, the Commissioners are unanimous in recommending the upland waters in preference to water taken from the Hudson River, although they admit that the latter can be made pure by filtration and, indeed, must be regarded as the ultimate reserve for the demands of the more distant future. It is recommended that in any case the city begin at once the construction of filters, both for the present Croton water supply and for all other waters taken from surface streams. The surveys upon which the report is based include about 125 miles of aqueduct location extending from Jerome Park reservoir to the site of the proposed reservoirs, and comprising 80 miles of surface aqueduct following the contour of the ground, 40 miles of aqueduct in tunnel, and about 5 miles of large steel pipe siphons. Although the works that it is recommended to put in hand at once contemplate an additional supply of not over 200,000,000 gallons a day, for obvious reasons the aqueduct has to be built of sufficient size to accommodate the ultimate 500,000,000 gallons daily capacity of the larger scheme, when it shall have been fully developed. The controlling feature as regards speed of construction will be the great line of aqueduct; and as this will take at least five years to complete, it is recommended that immediate steps be taken to initiate this greatly needed work. The conclusions of the report will be found in full in the current issue of the SUPPLEMENT.

The recommendation that immediate steps be taken to increase the water supply of New York is one that will commend itself to every one who has studied the situation. The present margin of consumption over supply is none too large; and when it is remembered that New York adds to itself every year a population equal to that of a first-class city, the urgency of the case is at once apparent. Whatever is done should be done on the most liberal scale. It has too often transpired that water supply provisions that looked overbountiful when they were projected, have proved meager in proportion to the ever-accelerating growth of the municipalities that they supply. This 500,000,000-gallon aqueduct looks like a gigantic scheme; but the growth of this city is gigantic; and it would take a bold prophet to set a limit to water demands of the future metropolis of the world.

PIPE GALLERIES VS. UPTURNED STREETS.

A contemporary has estimated that on July last, exclusive of the excavations for the subway, there were thirty-two miles of open trenches in New York city. Large as the estimate is, it is probably rather under than over the mark, for it is undeniable that the condition of the streets of this, the metropolis of the Western Hemisphere, is not merely a source of untold annoyance and loss to the citizens of the city, but is a positive blot upon a municipal administration which should be a pattern for the world at large and not a by-word and a reproach. It is to the credit of the Rapid Transit Commission and its engineers that the original plans of the subway contemplated the construction of pipe galleries; and it was simply because of the vicious obstruction of certain Tammany politicians in other departments that the subway plans were abandoned and the pipes laid above the roof of the subway, a few feet below the street surface. But although the mischief has been done on the 20 miles of road now approaching completion, there is no reason why a properly constructed gallery should not be built on either side of every new branch of the subway that is contemplated in the plans for future enlargement of the system. In any case, subways or no subways, there is absolutely no excuse for the shocking condition in which our streets are left when a section of the subway is completed, or the street surface is taken up for the laying or repairing of gas, electrical, or water mains. We presume that there is a clause in the Rapid Transit contract, and a statute in the city laws requiring that when the street surface is broken up for any cause whatever, it shall be restored at once on the completion of such work to as good condition as it was when the work was opened. As a matter of fact contractors and other disturbers of the street surface seem to be permitted to leave the street in just whatever condition of disrepair they may please, with the result that scores of miles of our thoroughfares are left in a disfigured condition for months after the job of pipe laying, sewer construction, etc., has been completed. We commend this matter to the attention of the Rapid Transit Commissioners and the Commissioner of Public Works.

AT LAST, THE SIDE-DOOR PASSENGER CAR.

For many years the SCIENTIFIC AMERICAN has been an urgent advocate of the use of a modified form of side-door passenger car for suburban service. It is a well-understood fact among railroad men that the speed of suburban service, other things being equal, is dependent upon the quick starting and stopping of the trains and the speedy discharge and taking on of passengers. The first has been solved by the electric motor, and the solution of the second lies in the substitution of the side-door for the end-door car. There is no company in America that has had such wide experience in heavy suburban passenger service, or has given so much intelligent thought to the problem, as the Illinois Central Railroad. More than a decade ago, when they had to make special provision for handling the millions that traveled between Chicago and the World's Fair, they designed and built a special side-door passenger car, which was a revelation to travelers in the speed with which it could be emptied and filled, and the marked effect it had upon the frequency of the train schedule and the average speed of the trains. The lesson learned in that successful experiment was not forgotten, and the same railroad has now brought out a large standard passenger coach for suburban service, capable of seating a hundred passengers, and constructed with a dozen side doors, one opposite each pair of seats. By the courtesy of the officers of the road, we are enabled to present in the current issue of the SUPPLEMENT an illustrated description of this interesting and, as we think, epoch-marking car. While we refer our readers to the article in the SUPPLEMENT, we may mention here that the carrying capacity of the new car, per foot of length, is 55 per cent greater than that of the standard end-door cars now in use. The experience gained in the few days that the cars have been in service has shown that their capacity and speed of loading and unloading is greatly in advance of that of the standard type. A careful timing at one of the intermediate suburban stations showed that from one of these cars forty-six passengers were unloaded in two seconds, about half of whom were lady passengers that were riding upon the new type of car for the first time. Contemporaneously with the improvement in the passenger-handling ability of the car, careful attention was given to the subject of indestructibility by fire or collision, and the construction, with the exception of the inside and outside finish, is entirely of steel. The under frame consists of four 9-inch steel I-beams, the end sills and car framing being also steel channels and I-beams, and the whole metal under framing is covered with a continuous steel floor of ¼-inch plating. The framing of the sides and roof is of steel, and heavy vertical steel trusses are provided in the walls of the car at each end, which will effectually prevent that most frightful cause of death and maiming in collision known as telescoping.

We have drawn special attention to this car because it is our belief that just now, when the extension of the Rapid Transit facilities of this and other large cities are being so thoroughly reorganized and reconstructed, it will be the greatest pity in the world if the capacity of these systems should be limited by an over-conservative adherence to the end-door type of car with its congestion of passengers and its too-slow loading and unloading at stations. In the car under consideration the objections to the English car have been met and cleverly eliminated, the seats, which are arranged transversely of the car, being placed down the center of the car, and two side aisles provided, which extend for the full length of the car. This arrangement allows a passenger to board the car immediately opposite any point on the platform where he may be standing, and look for a vacant seat while the train is in motion, thus avoiding the only cause of delay on the otherwise speedily loaded and unloaded English car. The side doors are so arranged that they may be opened individually by those who wish to leave the train, and shut collectively by the brakeman from the platform.

THE 60,000 HORSEPOWER PLANT AT THE WORLD'S FAIR.

BY LIEUT. GOLFREY L. CARDEN, R.C.S.

The floor space in the Machinery Hall of the World's Fair, St. Louis, 1904, has been applied for some four times over. It is now practically finished and the adjoining Steam, Gas, and Fuel Building is over 60 per cent completed. This latter building is a steel, fire-proof structure, measuring 326 by 300 feet. The total length of Machinery Hall is 1,000 feet and along more than one-half of this distance will be found prime movers constituting the power plant of the Exposition.

It was originally supposed that 40,000 horse power would suffice to perform all the functions devolving upon a power plant at the Exposition; but more than 60,000 horse power is now planned for installation in the Machinery Building, and of this amount a trifle more than 50,000 horse power has been assigned work in the service of the World's Fair.

In a previous number of the SCIENTIFIC AMERICAN, a list was given of the prime movers of the larger sizes entering into the power plant proper, and in reverting to that description it is only necessary to remark that the principal units will comprise gas engines, high-speed steam engines, and turbine engines from various parts of the world. One offering comes from as far east as Stockholm, while still another unit comes from a point as far west as San Francisco. The locations of the prime movers have been definitely decided upon, and the work of installing will commence during the coming month. As planned by Mr. Thomas M. Moore, chief of the machinery department, there has been allotted a good reserve of power for each particular line of work, and the units utilized in common service will be found grouped together. Take for example, the Intramural Railway. This road has a length of about seven miles and is a double track trolley system throughout, with standard gage and standard type of open cars. The motor equipment, the brake equipment, and the power plant for the operation of the road all constitute exhibits, and one of the units of the power plant comes from San Francisco, another from as far east as Berlin. The Intramural Railway power plant will be located in the central portion of Machinery Hall and the prime movers in this plant are as follows: (1) A 1,750 B. H. P. Oechelhauser system gas engine (100 R. P. M.) built and exhibited by A. Borsig, Tegel-Berlin, and supplied with gas from a producer plant built and exhibited by Julius Pintsch, of Berlin; (2) a 900-horsepower Corliss type steam engine (85 R. P. M.) built and exhibited by the Murray Iron Works Company, of Burlington, Iowa; (3) a 750-horsepower modified Corliss steam engine (100 R. P. M.) built and exhibited by the Lane & Bodley Company, of Cincinnati, Ohio; (4) a 600-horsepower four-valve steam engine (150 R. P. M.) built and exhibited by the Harrisburg Foundry and Machine Works, Harrisburg, Pa.

In addition to the foregoing it is proposed to utilize a tangential water wheel built and exhibited by the Abner Doble Company, of San Francisco, Cal. The combination will consist of a steam pump built by the Jeanesville Iron Works Company, which is planned to deliver 1 200 gallons of water per minute at a pressure of 300 pounds; the water is conveyed through a pipe line and delivered against the tangential water wheel. This latter will be directly connected to a Crocker-Wheeler generator. The water wheel will be incased in plate glass, and when making 900 revolutions per minute 1,000 horse power will be developed. Incidental features will be a Lombard governor on the water wheel and a Venturi meter measuring the water delivered through the pipe line.

All of the generators for the prime movers of the Intramural power plant will be of the Crocker-Wheeler

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type, and in every instance they are directly coupled to the prime movers and deliver current at 550 volts at the switchboard.

As a further instance of work devolving upon the power plant, take the water-pumping requirements. At the Paris Exposition the pumping service called for 45,000 gallons of water per minute; at St. Louis, the requirements are 90,000 gallons of water per minute. This water is to be lifted by three centrifugal pumps of the Worthington type, which pumps are entered as exhibits. Each is planned to deliver 30,000 gallons of water per minute against a total head and suck of 158 feet. Three induction type motors, each of 2,000-horsepower rating, are to operate the pumps. The energy required for the operation of this feature alone equals the total energy had from the Niagara power plant by the Pan-American Exposition, and the total energy availed of for illuminating the Buffalo Exposition.

It may be interesting to note, with reference to the waterways, that the main one consists of a grand basin with lateral lagoons. The water is delivered into this basin from a niche in front of Festival Hall and from fountains in front of two ornate restaurant buildings which flank the Terrace of States. From these three points it flows over cascades, and it is to be illuminated by electric lights placed under the lip of each step which breaks the spill.

Speaking generally, about 80 per cent of the energy developed by the power plant will be in 6,600-volt alternating current, three-phase, 25 cycles, this for the general lighting and hydraulic work of the Exposition; but there will be a material amount of 2,300-volt, 50 cycles, three-phase alternating current, generated by foreign exhibits and used for arc lighting, and there will be the 550-volt direct current, for the operation of the Intramural Railroad. In addition to the foregoing, there will be minor installations for the generation of both alternating current and direct current of standard voltages and characteristics, for the motor service of exhibitors in Machinery Hall.

More than a year ago the claim was made that the steam boiler, boiler appliances, gas producer, and fuel handling propositions would be adequately and creditably housed in a spacious building and that this building would be found in the center of the ground. This claim has been made good, and at this writing a steel structure in close juxtaposition to Machinery Hall proper is rapidly nearing completion, and in outward appearance this latter building, known as the Steam, Gas, and Fuel Building, will be architecturally in full keeping with the main Machinery Hall.

In this annex it is proposed to illustrate the most modern methods and economy in steam and gas generation and the handling and treatment of fuels; and, parenthetically, it may be remarked that the most exhaustive methods will be followed to secure absolute and reliable data as to the performance of every plant under the control of the Machinery Department. The reports will be embodied in the final Exposition reports to the United States government, and will doubtless be availed of by the foreign commissioners in reporting to their respective governments. In this connection, take the announcement of one of the fuel-gas producing companies that they will require, when developing 1,750 horse power in one of the gas engines of the power plant, 1,575 pounds of anthracite coal per hour, and when not operating, 50 pounds of anthracite coal per hour. This means less than 1 pound of coal per horse power per hour, and if the claim is made good as a result of six months of Exposition service, there will be some valuable data at hand from wholly disinterested and capable observers.

Economical illustrations in the Steam, Gas, and Fuel Building will commence with the coal in 50-ton, hopper-bottom, self-cleaning, steel cars controlled and operated by the Exposition. These cars bring the coal from the mine to the Fuel Building, where it is dumped and automatically conveyed to and from bunker and crusher, or either, and thence to the mechanical stokers, gas producers, and briquetting machines. Over 2,200 lineal feet of conveyor lines are required in this automatic coal-handling system. Bituminous coal, anthracite coal, briquettes, and crude oil will all be used for the purpose of providing lines for comparison and to illustrate as fully as practicable the broad subject of the use of fuels for power purposes. Every attention will be paid to the avoidance of smoke, and special facilities will be accorded stoker builders to substantiate their claims in this direction. In this building will be found a line of marine water-tube boilers representing nearly all the more distinguished types in service in the world to-day, and a separate stack will be available if called for by any one exhibit, provided at least 1,500 horse power is involved.

A permit has been granted to the Philadelphia, Washington and Baltimore Division of the Pennsylvania Railroad to build twin tunnels under the United States capitol. Electricity is to be the motive power.

THE HEAVENS IN OCTOBER.

BY HENRY NORRIS RUSSELL, PH.D.

Though the part of the sky which can now be well seen in the evening is not a very brilliant one, we may yet find much to interest us in identifying the various constellations which are now visible and the planets which happen to be in sight.

We may well begin with the brightest object of all—the planet Jupiter. At our usual hour (10 P. M. at the beginning of the month, 9 P. M. in the middle, or 8 at the end) he is a little to the east of south about half way up the sky, and cannot possibly be mistaken for anything else.

Above Jupiter is the great square of Pegasus, which is very easy to recognize. Its right-hand side points downward toward the planet. Farther down on the same line is an isolated bright star. This is Fomalhaut, which, with the small stars, nearly forms the constellation of the Southern Fish.

The lower side of the great square of Pegasus, prolonged to the right for about three times its own length, brings us near a bright star in the Milky Way with a fainter one on each side of it. This is Altair, which, like Fomalhaut, is quite near us, speaking from the astronomical standpoint—a mere matter of eighty or a hundred millions of millions of miles. The little diamond-shaped group between Altair and Pegasus is Delphinus, sometimes known to sailors as Job's Coffin.

The bright object below and to the left of Altair is the planet Saturn. The two small stars in between are in Capricornus, and are the brightest in that constellation. Both are worth looking at with a field-glass.

Aquarius, in which Jupiter is now situated, is also lacking in conspicuous stars. Its most characteristic group, resembling the letter Y lying on its side, may be found by prolonging the diagonal of the great square of Pegasus downward and to the right for about its own length.

The opposite diagonal, carried up into the Milky Way, lands us in Cygnus—a very fine constellation, with the familiar "cross" of bright stars—and, extended farther, comes near Vega, the very bright bluish star which marks the constellation Lyra. Below Vega, and more to the right, is Hercules, now well down in the west.

Returning once more to Pegasus, we notice that from the upper left-hand corner of the square there extends a line of fairly bright stars. The first two of these are in Andromeda. The third, at a little greater interval, is Alpha Persei, while the one below, and rather out of line, is the famous variable Algol.

Still farther on is Auriga, with the brilliant Capella. Farther south is Taurus, with the ruddy Aldebaran just rising, and the silvery Pleiades higher up.

Below Andromeda a little triangle marks the head of Aries. The large constellation, Cetus, fills most of the sky lower down, extending from the edge of Taurus nearly as far as Fomalhaut.

Of the circumpolar constellations, Ursa Major is directly below the pole. Draco and Ursa Minor are on the left, and Cepheus and Cassiopeia are above it.

Beta Andromedæ, the first star of the line that runs northeastward from the great square of Pegasus, may be used to help us find a very interesting object. A short distance northward of it, in a direction at right angles to the main line of stars, we come upon a small star of about the fourth magnitude, and then on a second, a little out of line. Just beyond this, and exactly in line with Beta and the first star, is a hazy patch of light, visible to the naked eye, but much more conspicuous with a field-glass. This is the great nebula of Andromeda—the brightest of all such objects and the type of a large class of nebulæ.

Viewed with a small telescope, it appears only as a dull mass of light, with no well-defined boundaries, but concentrated rather sharply to a central nucleus. With large visual telescopes two parallel dark lanes or streaks can be detected near one side of the nebulosity, but this is about all. But long-exposure photographs tell a very different story, and show that this nebula, so insignificant to the naked eye, is really one of the most magnificent objects in the heavens.

So many of these photographs have been reproduced that the majority of our readers are probably familiar with their appearance. They show that the dark lanes visible to the eye are only parts of a much more extensive system, which divides the nebula into a series of concentric elliptical rings. The impression given by the photographs is of a vast, thin, flat sheet of luminous matter, nearly circular in actual form, but much foreshortened by being seen at a high angle. The outer parts of this sheet show a cloud-like structure, and are arranged in spiral streams, which can be followed as they wind gradually in toward the center until they are lost in the glare produced by the over-exposure of the bright inner part of the nebula. The dark lanes seem to be simply the places where we look through between these luminous clouds to the dark sky beyond.

The whole appearance of the photographs suggests strongly the idea of the old nebular hypothesis—a shrinking mass which, as it contracts, throws off rings ready to condense into planets. But we must be cautious in adopting any such view, especially as the theory on which it is based is now being severely criticised upon mathematical and physical grounds.

The real constitution of this nebula, and of the many others which resemble it in general characteristics, is still uncertain. Its spectrum appeared to its first investigators to be quite continuous. This is very puzzling, as it would seem to follow that the light of the nebula comes from glowing solid or liquid matter, or from gas under a high pressure.

More recent photographs of its spectrum have brought out the still more important fact that it contains faint dark lines, and resembles the solar spectrum in general character, though the lines are faint and diffuse.

The existence of these dark lines is not universally admitted, and further observations are desirable, but the writer is disposed to believe in their reality.

Now the only way that we know of by which such dark lines in the spectrum can be produced is by the selective absorption of a highly heated atmosphere like the sun's. It is inconceivable that the nebula as a whole can have such an atmosphere, and so we are led to the conclusion that it must consist of a mass of stars.

Many attempts have been made, from the time of Herschel downward, to resolve this nebula into stars, but even the most powerful telescopes fail utterly to do so. If it really consists of stars, they must be so small, or so enormously far away, that they cannot be seen individually even with the largest instruments, but form a mass of diffused light, just as the stars of the Milky Way do to the naked eye.

This theory appeals keenly to the imagination, for if it is true this nebula may be an assemblage of stars even greater in extent than the whole of the Milky Way, and at a correspondingly enormous distance from us—one which it might take light a million years to travel.

It seems pretty sure that, viewed from such a distance, our own Galaxy would appear as a spiral or a ring nebula, something like the Great Nebula, though without its central condensation, and it is certainly possible that the Andromeda nebula may be of this character—another "universe" perhaps more extensive than our own. But it must be clearly borne in mind that the evidence available at present is too scanty to justify us in making any definite statement to that effect.

THE PLANETS.

Mercury is evening star until the 3d, when he passes through inferior conjunction and becomes morning star. He will not be visible till the latter part of the month. On the 18th he reaches his greatest elongation west of the sun, and rises about an hour and twenty minutes before him, so that he should be seen without much trouble near the horizon, a little south of east, at about an hour before sunrise.

Venus is also morning star, and is very conspicuous, rising an hour and a half before the sun on the 1st, and more than three hours before him on the 31st. During the first part of the month she rapidly grows brighter as her narrow crescent widens, and at the time of her greatest brilliancy, on the 24th, she is twice as bright as she was on the 1st. Later on she slowly decreases in brightness.

Mars is evening star in Scorpio, but is inconspicuous, being faint and far south. On the 3d he is quite near Arcturus—about 3 deg. north of the star. In the middle of the month he sets at about 8 P. M.

Jupiter and Saturn are in Aquarius and Capricornus respectively, as already described, and are both well placed for evening observation. Saturn is in quadrature on the 27th.

Uranus is in Ophiuchus, and has practically disappeared for the year, as he sets at about 8 o'clock. On the 24th he is in conjunction with Mars, being about 1¼ deg. north of the latter. Neptune is in Gemini, and rises at about 9 P. M. on the 15th. It will be a couple of months yet before he can be conveniently observed in the evening.

THE MOON.

Full moon occurs at 10 A. M. on the 6th, last quarter at 3 P. M. on the 13th, new moon at 10 A. M. on the 20th, and first quarter at 3 A. M. on the 28th. The moon is nearest us on the 16th, and farthest away on the 28th. She is in conjunction with Jupiter on the 4th, Neptune on the 12th, Venus on the 17th, Mercury on the 19th, Mars and Uranus on the 24th, Saturn on the 28th, and Jupiter again on the 31st.

On the 6th there occurs a large partial eclipse of the moon, seven-eighths of which is obscured. It is invisible in America, but can be seen throughout Asia and in part of eastern Europe and Africa.

Florence, Italy, September 3, 1903.

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THE SIEVERT PROCESS OF MECHANICAL GLASS BLOWING.

Every maker of glass utensils knows the effect of cold metallic surfaces upon the superficial ductility of glowing plastic glass. The sudden absorption of heat causes the upper layers of glass to harden in innumerable ridges and lumps. Blown glass, on the other hand, coming as it does in contact only with the atmosphere as it hardens, preserves the mirror-like gloss

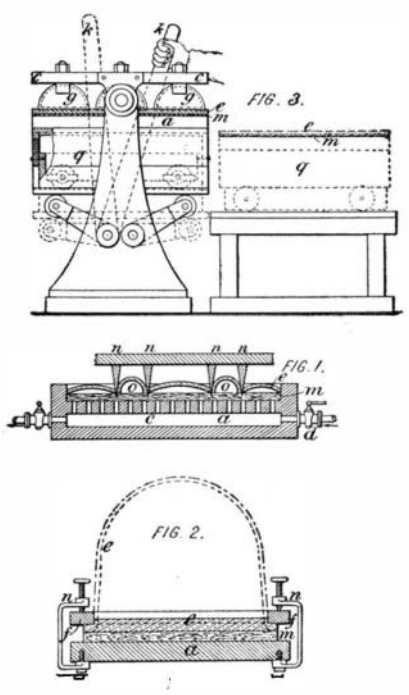
Bas-Relief of Emperor William II. Blown in Glass.

of a fluid that has congealed, undisturbed. It is likewise well known to the glass-maker that if the tools with which the glowing glass is handled be moistened, a layer of steam is formed between the glass and the tool, which layer conducts away but little of the heat. The principles which underlie these phenomena have been practically utilized by Mr. Paul T. Sievert, of Dresden, Germany, in the glass-blowing process which we described in our issue of May 10, 1902, and also in a process which was there referred to, but which will in this article be more particularly described.

Mr. Sievert's attempts to roll out molten glass into plates by means of rollers and rolling tables, the surfaces of which consisted of water-soaked fibrous material such as wood, paper, asbestos, and the like, were at first not altogether crowned with success. During the rolling process the injurious effect of the cold metallic surface was particularly marked. Here then was a most excellent opportunity for utilizing not a metallic surface, but a layer of vapor in direct contact with the congealing glass. The water-soaked rolling-tables, however, were found to be defective in certain important respects. The steam generated between the moist bed-plate and the molten glass must be allowed to escape. If the glass surface be very large, and the bed-plate more humid at some points than at others, steam will be generated in larger quantities in such places and will there have a greater expansive force, with the result that a bubble will be formed. This peculiar effect caused by variable humidity has been turned to good account by Mr. Sievert. If the glowing layers of glass resting upon the moist bed-plate, or rather upon the layer of steam generated, be tightly forced into contact with the bed-plate at its edges so that the steam cannot escape, it follows that the steam generated must force the superposed glass layer upward into a huge bubble. In Mr. Sievert's earlier patents we find these principles practically applied for the first time.

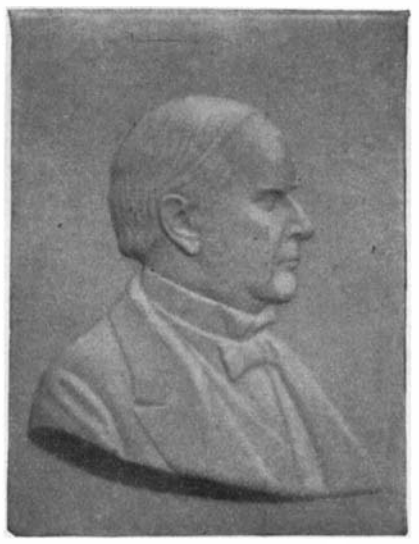
The plastic layer of glass *e* (Fig. 1) is laid upon a layer of asbestos *m*, which is fed with water through the inlets *c*, in the upper surface of the hollow plate *a*. The layer of steam generated forces the glass upward by reason of the fact that the glass layer is pinned down to the bed-plate by fingers *n*, so that the steam cannot escape. A second application of the same principle is somewhat broader in its scope. A plastic layer of glass *e* (Fig. 2) is placed on a layer of asbestos, which is kept moist by a supply of water. Upon this layer of glass a frame *f* is superposed, and held down tightly by clamps *n*. The layer of steam formed beneath the glass cannot escape, because the edges of the frame and the sheet of asbestos form an air-tight joint. Hence the steam must act upwardly, and the layer of glass is blown into a hollow body. The pressure of the steam, and consequently the size of the bubble formed, can be regulated by adjusting the clamps *e*. A third patent discloses the fact that the upward blowing of the layer of glass by means of a layer of steam is but a single instance of the practical application of a general process. It is recognized that molten glass can be spread upon the bed-plate, pinned down by a clamp frame having the shape of the body which is to be formed, and forced into a mold by means of compressed air, steam, or other elastic fluid. It is this particular process which has been described in the issue of the SCIENTIFIC AMERICAN previously referred to.

In practically carrying out these processes the system illustrated in Fig. 3 is adopted. The figure in question illustrates an amplification of the apparatus outlined in Fig. 2. Upon the carriage *q* the bed-plate *a* is placed, and upon the bed-plate a wet layer of asbestos *m* is superposed. Upon the asbestos plate in turn the layer of glass *e* is spread. The carriage *q* is now pushed beneath the plate *c*, so that it assumes the position indicated by dotted lines. By means of



Figs. 1-3.—Sievert Process of Glass Blowing.

a lever *k*, the carriage and the plate *c* are raised sufficiently, as shown by the full lines, to enable the molds *g*, secured to the frame *s*, to force their edges into the layer of glass. Thereupon, the steam arising from the asbestos forces the layer of glass into the molds *g*. The carriage *q* is then lowered and withdrawn together with the objects which have been formed, tied together by surplus glass. By means of the apparatus shown it is possible to produce no less than twelve tray-like utensils at a time. It is with this apparatus that the



Glass Bas-Relief of President McKinley.

glass bas-reliefs of Emperor William II. and of the late President McKinley, herewith reproduced, were made.

Rules Adopted by Wireless Telegraph Conference.

The conclusions of the international wireless telegraph conference held in Berlin last month have been made public, and the protocol signed at the conference will probably be made the basis of a treaty for the regulation of international wireless telegraphy.

Rules were adopted applying to the exchange of messages between vessels at sea and coast stations. These rules are said to be as follows:

"Any fixed station whose field of action extends to the sea is styled a coast station.

"Coast stations are bound to receive and transmit telegrams originating from or intended for vessels at sea without any distinction of wireless telegraph system used by the latter.

"The contracting parties shall publish any technical information likely to facilitate or expedite communications between coast stations and ships at sea.

"The wireless station must, unless there should be absolute impossibility, accept in preference requests for help that may come from vessels.

"The service of the wireless-telegraph stations must be organized as far as practicable so as not to interfere with the service of other stations."

It is expected also that a universal system of charge is to be introduced.

The protocol was signed by the United States, Germany, Austria, Spain, France, and Russia. The general feeling of the congress seemed to be decidedly against the monopolization of the wireless-telegraph business by any one company.

The maximum draft allowed for ships using the Suez Canal was raised in 1902 from 25 feet 7 inches to 26 feet 3 inches, or 8 meters, and 123 ships availed themselves of this increased depth.

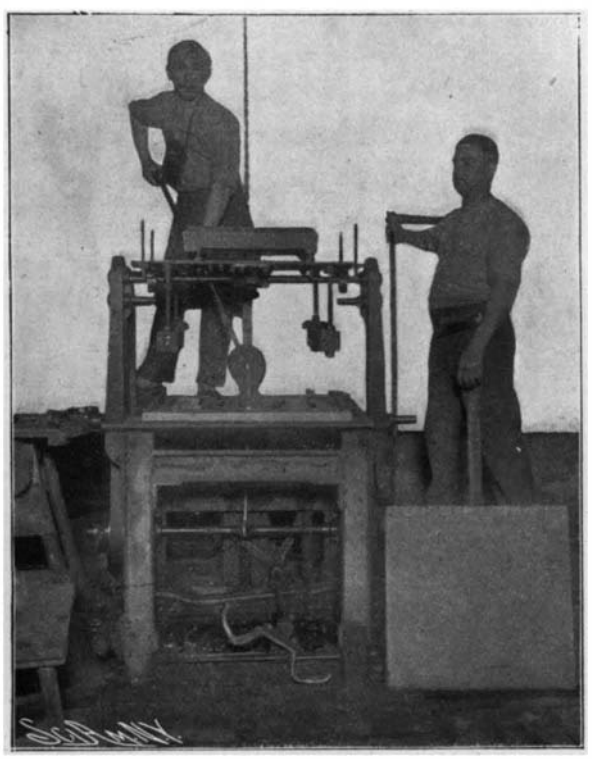


Fig. 4.—Spreading the Molten Glass on the Asbestos Plate.

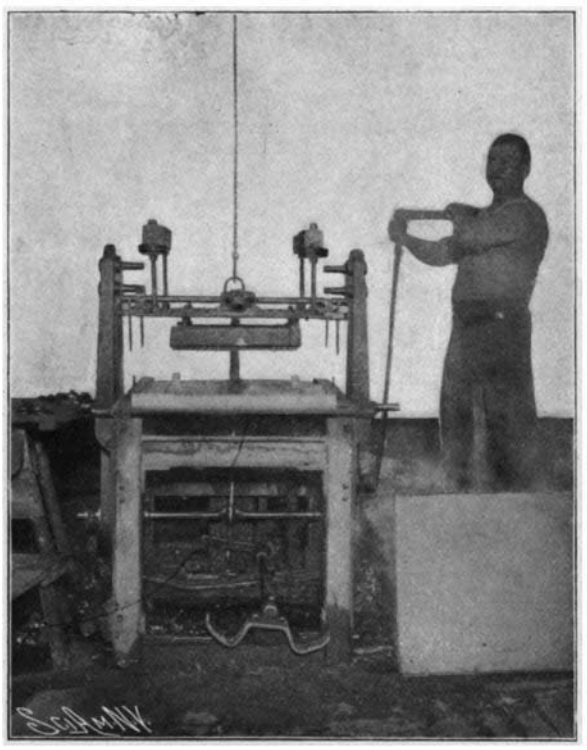


Fig. 5.—Blowing the Glass into the Mold.

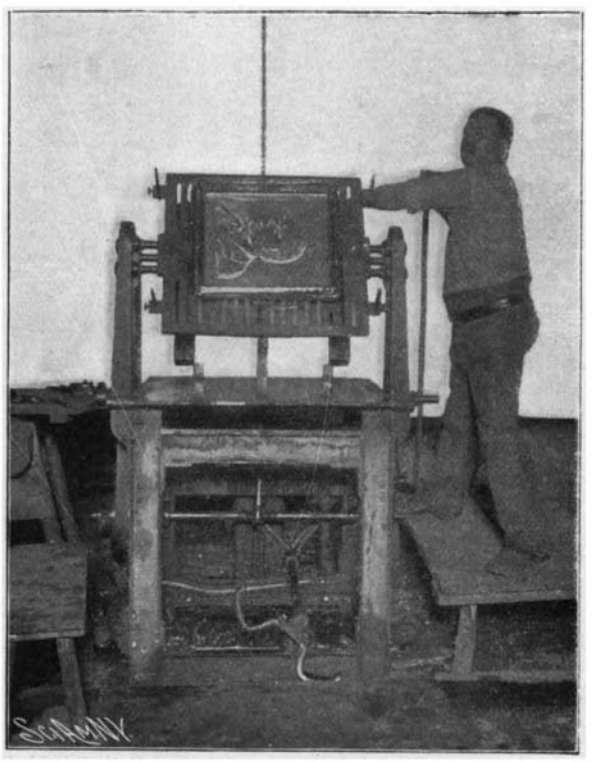


Fig. 6.—Lifting the Plate and Tipping the Mold with the Blown Product.

THE SIEVERT PROCESS OF MECHANICAL GLASS BLOWING.

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LONDON'S GASOLINE-PROPELLED CABS.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

A new type of cab propelled by a gasoline motor is being introduced into London to take the place of the hansom cabs so much in vogue in the English metropolis. This new type of vehicle, as may be seen from the accompanying engraving, comprises the cab with accommodation for two passengers, and a seat in front for the driver. The cab itself is similar in design to the hansom at present in use, only it is much larger and more roomy. It is provided with a glass front fitted with a spring attachment, which permits its being raised or lowered instantly as desired.

The driver's seat is only half the width of the chassis, sufficiently large to seat the driver only, so that the passengers within the cab can obtain practically an uninterrupted front view. The cab is slung upon four wheels, which renders it far safer and more immune from the dangerous accidents to which the two-wheeler is so subject. The chassis is of Paris manufacture, with a twin cylinder Aster engine developing 12 horse power placed in the front of the vehicle beneath a bonnet in the usual manner. Three speeds and reverse are provided, the maximum speed being 25 miles per hour. The two lesser speeds are comparatively low, especially the first speed, so as to enable the vehicle to readily climb hills. The second speed has been designed so that the car can be easily handled in congested traffic without any possibility of the engine's racing. The drive is transferred from the gear box to the rear live axle through a universal coupling. Change of speed is effected by means of a side lever, and steering by wheel. The gasoline tank is placed beneath the driver's seat; its capacity is seven gallons. Jump spark ignition by means of accumulators is employed. To prevent side slipping as far as possible, which is very frequent upon the London streets, especially in wet weather, owing to asphalt and wood entering so extensively in the paving, the cab has been provided with a long wheel base, and the weight has been reduced to a minimum by the employment of aluminium. The wheels are equalized, of the artillery type, and shod with pneumatic tires.

These cabs are to ply for hire in the same manner as the present horse-drawn hansoms. The same fare of two miles for 25 cents in American money will be charged. Seventy-five of these cabs are to be installed immediately. Ordinary hansom-cab drivers are being taught the management of the vehicles, in preference to employing automobile chauffeurs. The new cabs will not only be safer than the existing hansoms, but will be more speedy and comfortable, and the cost of upkeep, even after allowing for depreciation, will not be so expensive as the horse vehicles.

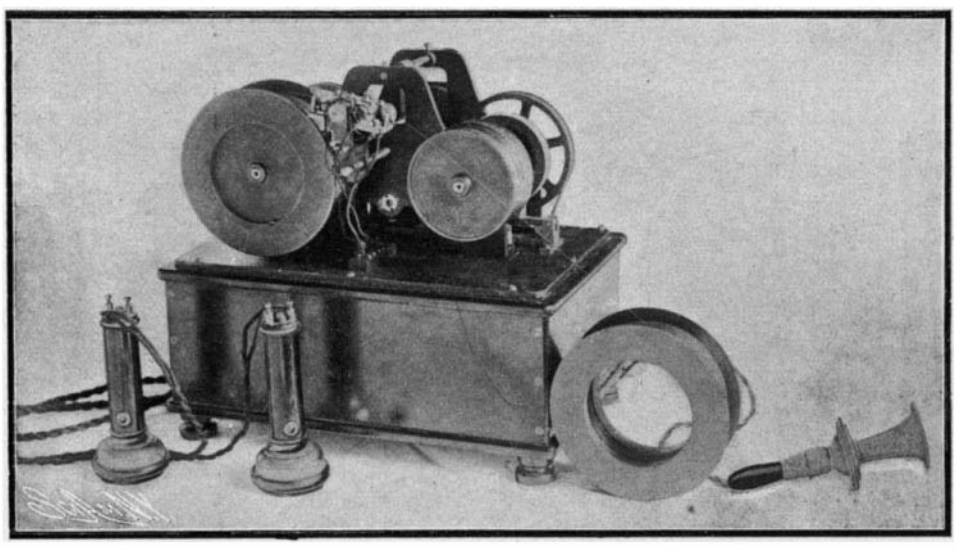
ONE OF THE NEW GASOLINE CABS OF THE CITY OF LONDON.

Compared with these light and rather graceful London cabs, the hansoms that thread the streets of New York in particular, and most large American cities in general, seem decidedly at a disadvantage. New York's public electric vehicles are certainly clumsier in appearance. In cost, too, Americans have to suffer. An Englishman can travel about comfortably for about one-third the money that would be exacted in New York for a journey of like length. Why it is not possible to provide a system of cheap transportation somewhat similar to that of London is a question with which few Americans seem to concern themselves.

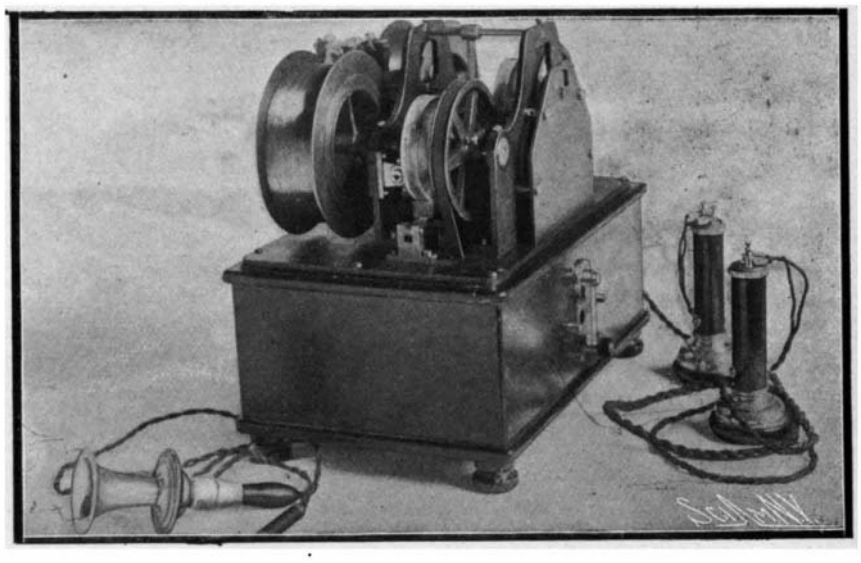
THE NEW TELEGRAPHONE.

The Poulsen telegraphone has been so fully described in these columns that the only excuse for still another account of the instrument is to be found in the marked improvements which have been made. New instruments have been brought to this country which are considerably more compact and more efficient than the old. The principle of the invention, however, remains unchanged. It will be remembered that current from the secondary coil of an ordinary microphone and induction coil system is sent through a small electro-magnet, past which a steel surface is moved. Each molecule of the steel surface is magnetized to a degree corresponding with the current variations set up by the voice in the speaking circuit. In order to reproduce the sounds of the voice thus magnetically recorded, it is necessary simply to connect the coil with an ordinary telephone receiver, and to pass the magnetized steel surface again under the magnet. In one of the forms previously described in these columns, the steel surface was a wire, spirally wound about a drum, rotated at a constant speed, mechanically or by hand. In its general appearance, the instrument was not unlike the Edison phonograph; it had a carriage which moved forward at a constant speed as the cylinder with its wire turned beneath it.

Impelled probably by the desire to produce an instrument resembling the disk type of phonograph, Poulsen has designed an instrument in which a steel plate is used instead of a wire spirally-wound about a cylinder. In its manner of operation this new instrument resembles the ordinary gramophone. The disk is rotated by clockwork in the same way. The records are not produced with the full loudness of the ordinary gramophone; still, they are entirely distinct and are singularly free from the scratching

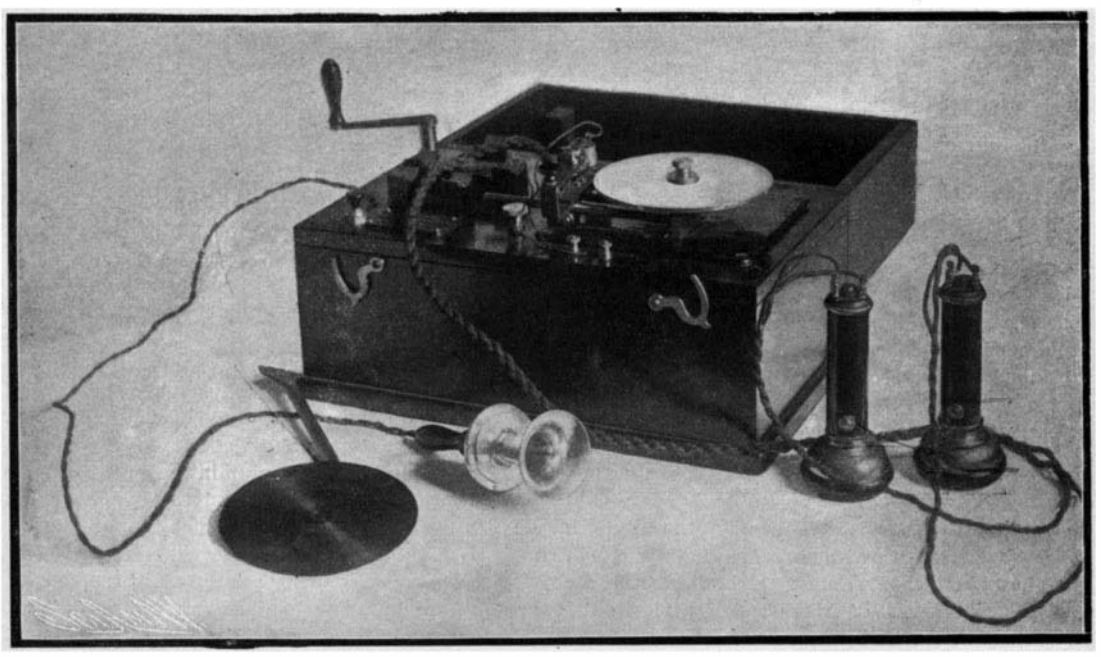


Wire Type of Telegraphone with One of the Reels Removed.



End View of the Wire Telegraphone.

Details of the Disk Type of Telegraphone.



The Poulsen Telegraphone.—Disk Type.

THE IMPROVED TELEGRAPHONE.

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and hissing occasioned by the stylus as it passes over the wax surface. The steel disk which receives the message is about 5 inches in diameter, and is secured to a rotating plate by a milled nut. As the disk rotates, the magnet and coil, which are held in a carrier, are gradually moved toward the center of the disk by a micrometer screw. The speed of rotation is increased as the magnet approaches the center of the disk, so that the disk rotates beneath the magnet with a constant linear velocity of one-half a meter per second. The record is easily erased by passing a bar magnet over the disk. In place of a pair of magnets with two coils, which characterize the earlier machines, a straight magnet is now employed. This magnet is a pointed needle which can be lifted out and renewed, the coil being imbedded in an insulating composition and held in a small ebonite cylinder.

Still another new form has been designed in which a steel piano wire is employed, wound off one wheel to another between two magnet poles by an electric motor contained in the base of the instrument. The speed is about 10.64 feet per second. Enough wire is carried on the reels to make a record three-quarters of an hour in length. Should only a part of the record be used at a time, its position can be noted by an indicator finger which rotates at a speed equal to that of the reels. In this machine three pairs of magnets and coils are used, each pair consisting of two magnets and coils similar to the straight magnets previously described. The magnets are placed horizontally, one on either side of the wire. The sounds are recorded by the middle pair of magnets, the pairs on either side serving for demagnetization or erasure. As the wire winds off, the magnet carrier travels back and forth, serving both to hold and guide the wire on and off.

By a reversing switch the motor can be reversed at one side, and one of the pairs of erasing magnets energized. If the wire is passing from right to left, the right-hand pair of magnets receives the current; any previous record that may be on the wire is completely erased. A new record can then be made, which can be heard by removing the microphone and using in its stead telephone receivers. The wire can be run back to any point, so that the instrument can repeat any part of the record. The second pair of magnets serve the purpose of enabling the wire to record a message while it is being run off from the right to the left, or from left to right, and the erasing magnets on the right or left are connected up (when the microphone and not the receivers are in use) according to the position of the reversing switch for the motor. It is a rather remarkable circumstance that, although the coils of wire are packed closely together on the reels, no demagnetizing effect is to be observed, nor is the record in any way impaired. In clearness of reproduction this wire instrument leaves nothing to be desired. The articulation could not be improved.

Death of Prof. Alexander Bain.

Prof. Alexander Bain, Lord Rector of Aberdeen University, died on September 17. He was born in 1818. At the age of eighteen he entered Marischal College, and received his degree of Master of Arts in 1840. After teaching for five years he was made Professor of Natural Philosophy in Andersonian University, Glasgow. Later he was connected with the Metropolitan Sanitary Commission and the General Board of Health and as Examiner in Logic and Moral Philosophy at the University of London. After having been appointed Crown Professor of Logic at the University of Aberdeen, he was elected Lord Rector of the University. Prof. Bain is known to scientific men chiefly for his works on natural philosophy. Among his best known books may be mentioned "The Senses and the Intellect," "The Emotions and the Will," "The Study of Character," "Logic, Deductive and Inductive," "Mind and Body: Theories of Their Relation." To students of English literature he is best known for his "Manual of English Composition and Rhetoric" and his "Rhetoric." John Stuart Mill wrote of him: "Bain has stepped beyond all his predecessors and has produced an exposition of the mind of the school of Locke and Hartley which deserves to take rank as the foremost of its class, and as marking the most advanced point which the *a posteriori* psychology has reached. . . . With analytic powers comparable to those of his most distinguished predecessors, he combines a range of appropriate knowledge still wider than theirs; having made a more accurate study than perhaps any previous psychologist of the whole round of physical science."

Statistics recently published by the Bulletin de l'Office du Travail of the strikes in France during 1902 show that more than half had for their object to obtain increases of wages; 111 times out of a total of 512 strikes this object was attained, 184 times there were compromises, and 213 times the strikers were unsuccessful.

Electrical Notes.

Austria's first standard electric railway was recently opened. The line extends between Tabor and Bechin, in Bohemia, and has a length of 15 miles. The maximum speed attained is only 19 miles an hour. That passenger traffic is strictly limited in this district of Bohemia may be essayed from the statement that a train consists of only two cars, with a carrying capacity for 40 passengers and 36 tons of goods. The new railway has a special interest from the fact that we believe it to be the first line to be entirely regulated by the telephone. There are no signals, the telephone being used by the driver in all cases to ascertain whether the line is clear. Each car is fitted with a portable instrument, which may also be used by the passengers.

A company is being promoted with the object of generating electricity by means of water power from the lakes on Snowdon and in the neighborhood of Conway. The current will be supplied to a short railway and to certain towns in the district of Snowdon, to local quarry owners, and in bulk to more distant consumers. It is the intention of the company to tap Lake Llydaw, which lies on the eastern slope of Snowdon, at an elevation of 1,416 feet above sea level. This lake is just over a mile long, and averages about one-sixth of a mile wide. This is equal to an area of about 5,500,000 square feet. It collects the rainfall from an area of about 47,000,000 square feet, and the average rainfall on this area is estimated at about 170 inches per annum. It is proposed to build a dam 150 feet long across a portion of the lake, and thereby raise the water 20 feet. The lake can be tapped 30 feet below its present level, or 50 feet below the proposed level, which is estimated to be equivalent to a storage of at least 250,000,000 cubic feet. The site for the generating stations will be at a point 11,200 feet below the lake, with which it will be connected by steel pipes. With this head the impounded water is estimated to be sufficient to provide 6,100 horse power for 90 working days, independent of any rainfall and permanent streams during that time.—Mechanical Engineer.

A process of producing carbon with a shining surface introduced by Siemens & Halske is described in the Elektrotechnische Rundschau. The process consists in introducing the positive pole into an electrolyte (acidulated water), and in exposing it to a tension of from 100 to 200 volts for a short time, when any carbon particles surmounting in the least the surface will be projected or oxidized, the surface assuming, instead of its unpolished aspect, a very high polish. This effect is due to the chemical action of the oxygen disengaged by electrolysis, and to the simultaneous influence of the high temperature produced by the process. The best course is to suspend in a vessel containing a suitable electrolyte—e. g., some sulphuric acid diluted in the ratio of 1 to 10—the negative pole of a source of current. The surface of this electrode may be chosen very small. After the carbon to be treated has been joined up to the positive pole of the current source and introduced into the electrolyte, the negative pole will, in spite of its small surface, remain dark, whereas a strong evolution of oxygen, in connection with luminous phenomena, is observed at the positive pole. If the carbon be taken out of the electrolyte after a few seconds, it is found to have taken a high polish. Tensions between 100 and 200 volts are the most suitable, the process being furthered by heating the electrolyte to a temperature near its boiling point.

In the Phys. Zeitschr., E. Grimsehl describes a novel sensitive aluminium leaf electrometer of his own design. The rectangular case is made of brass of dimensions 5 x 7 x 16 centimeters, and supported on three leveling screws. The back and front of the electrometer are furnished with glass plates sliding in grooves on the framework. Through an insulated ebonite stopper passes a vertical brass support for the three aluminium sheets. A piece of aluminium-foil, 90 x 3 millimeters, acts as the needle, and is supported between two thin sheets of aluminium 90 x 6 millimeters, of which one is fixed vertically and divides the charge with the needle, while the other turns on an insulated hinge from the same support and is earth-connected. This movable sheet of aluminium may be adjusted from the outside of the case until it is near the fixed sheet, and thereby increases the sensitiveness of the instrument. A graduated mica scale, reading from 0 deg. to 30 deg., serves to indicate the quantitative measurements, and the author claims that the instrument will show a difference of 2 volts when the movable and fixed aluminium are 4 deg. apart. When the distance is increased to 30 deg., each degree represents 10 volts. When not in use the needle is held lightly pressed between the two outer aluminium sheets. A condenser is fitted to the top of the electrometer in order to demonstrate the fundamental ideas of contact electricity. The instrument would be useful for experimenting with Becquerel rays or with ultra-violet light.

Engineering Notes.

During the month of July, 3,307 vessels, measuring 454,573 register tons net, used the North Sea and Baltic Canal, against 3,217 ships and 413,466 tons in the same month of 1902. The dues collected amounted to 211,501 marks, against 192,719 marks.

There are immense forests of Aleppo pines in Algeria, which have up to now been considered of little value; the suitability of this wood for road paving and for timbers for mines and telegraph posts, may have the effect of enhancing the value of these forests.

The Revue Generale des Chemins de Fer reports that in a series of experiments made at the shops of the Paris, Lyons & Mediterranean Railway on the radiating qualities of different methods of jacketing boilers, it was found that bare jacketing radiated less than the painted, the difference being from 55 to 185 heat units per square foot of surface per hour. In calm air and under the same conditions a single jacket of mineral wool radiated about one-half as much heat as a bare jacket, and one-third as much as a painted one. Where a double layer of mineral wool was used, the losses per square foot were about one-half as much as they were in the case of a single layer. With a double jacket and a layer of mineral wool between the losses were about one-half as much as they were with a single jacket without the wool. It was found that in air currents when the velocity was greatly increased the losses were doubled, and that a layer of mineral wool reduced these losses about one-half. The effect of painting is to increase the loss, but not to so great an extent as in calm air.

The increasing use of emery wheels in the engineering industry has naturally directed attention to the necessity of protecting the workman in the event of the bursting of these artificial grinding wheels. With a view to obtaining a device that will protect the workman against the flying fragments when a burst occurs, the Association des Industriels de France is offering a prize of 1,000 francs for the best design of emery wheel guard. The competition is an international one, and any design submitted is expected to meet the following requirements: (1) To be intended for a wheel mounted between two bearings; (2) to prevent the flying of fragments in the shop; (3) not to impede the execution of the work on whatever part of the wheel it be desired to perform this work; (4) to retain its effectiveness though the wheel be worn away; (5) to be adapted easily to the different types of wheel frames; (6) to be sufficiently cheap for a ready adoption. Competitors should deliver to the president of the association, 3 Rue de Lutéce, Paris, before December 1, 1903, a complete description of the device they offer, with drawings. Any further information respecting the competition can be obtained on application to the secretary of the association at the address mentioned.

Berlin has entered definitely upon the employment of electrical traction for suburban service on the State railways of standard gage. Since the middle of May experiments have been in progress on the line from the Potsdamer railway station in Berlin—the focal point of suburban traffic within the city limits—to Gross Lichterfelde, a distance of 5½ miles. These experiments having proven entirely successful, regular traffic was begun on July 15 with trains of three cars each, which depart in each direction every ten minutes and are permitted by ordinance to make a speed of 60 kilometers (37.2 miles) per hour. The current is supplied from the southwestern power station of the already existing circular railway (Ringbahn) and is transmitted over an insulated third rail laid beside the track, whence it is taken up by a contact shoe connected with the motor. Each train is made up of one second and two third class cars, each 63 feet long by 9 feet wide and which weigh—all three together—128 tons and seat 200 passengers. The second-class car is at the middle of the train and carries no motor. Each third-class car carries a motor at one end and these, being put at the front and rear of each train, enable it to run forward or backward as desired. The cars are new and as handsomely finished as their purpose would justify. They are equipped with heating apparatus for winter and would be considered comfortable and up-to-date even in the United States. The opening of this line is noteworthy because it marks the beginning of a general change from steam to electricity for the important and rapidly growing suburban service of Berlin. So comfortable, rapid, and convenient have the electric street railway connections become—especially the overhead and subterranean line which was opened in February, 1902—that aside from all considerations of economy the steam lines are constrained to go over to the new, clean, convenient, and more economical system of traction in order to hold their traffic and secure their business for the future. A second line, which leads to Cöpenick—several miles distant up the Spree—is in process of conversion to electricity, and will inaugurate the new method of traction during the summer.

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EUROPEAN FLOATING AND DOCK CRANES.

BY FRANK C. PERKINS.

In Europe considerable attention has been paid to the floating crane, and for dockyard work both stationary jib cranes and portable cranes have been extensively used. These cranes have been operated in various ways, steam power being chiefly preferred, while in some cases hydraulic cranes and compressed air cranes have been installed and given good satisfaction. Of recent years electric motors have been applied to cranes of all kinds, and have been found to be most economical in operation.

Floating cranes have the advantage of mobility, and for this reason are of especial value for harbor and dock work. They avoid the necessity of large ships being towed by a flotilla of small tugs to one of the few powerful stationary cranes, in order to take on one or only a few bulky pieces, the weight of which is too great for the general kind of dock cranes. Until recently floating cranes were constructed only in the shape of shear-leg cranes, which it is claimed naturally restricted their use considerably, and to remedy this defect a complete revolving crane was built on a pontoon. One of these cranes, noted in the accompanying illustration, is used in Hamburg harbor by the Hamburg-American Line.

The framework is very simple, and the projection of the crane can be adjusted from 8 to 17.5 meters. This adjustment makes the crane extremely useful and practical, as it enables the jib, without moving the position of the pontoon, to reach without difficulty between the deck superstructures and the masts and to lift or lower the cargo as required.

In order to keep the pontoon on sufficiently even keel when carrying the various loads, the crane has been provided with an adjustable counterweight, which latter is manipulated by the operator. But even if this counterweight should be wrongly manipulated on account of the carelessness of the operator, the pontoon crane remains comparatively stable. The driving power consists of two double-cylinder steam engines, symmetrically mounted on either side of the framework. The reversible hoisting engine has a stroke of 240 millimeters and a cylinder diameter of 180 millimeters. A second engine having the same dimensions is used for driving three sets of gear, which regulate the adjusting of the jib and counterweight, and the slewing of the crane.

Two working speeds are provided for the lifting gear, one for loads of from 15 to 30 tons, which has a rate of 3 meters per minute, and the other for smaller loads with double this speed. The crane revolves once in two minutes, and the reach is controlled by a long, heavy screw which engages a large nut, the screw being rotated by means of massive bevel gears, as shown in our engraving.

The steam boiler is located within the pontoon, and the steam is transmitted to the engines at a pressure of 8 atmospheres, by a pipe passing through the central pivot. The pontoon is 14 meters wide and 2.7 meters high, while the total length is about 30 meters.

In spite of the many adherents of electrically-operated cranes, the steam crane is the prevailing type in Europe. Considerable interest attaches to the powerful 150-ton derrick crane erected at the wharf of Blohm & Voss at Hamburg, Germany, which is shown in our front-page engraving, mounting a heavy gun on the battleship "Kaiser Karl der Grosse."

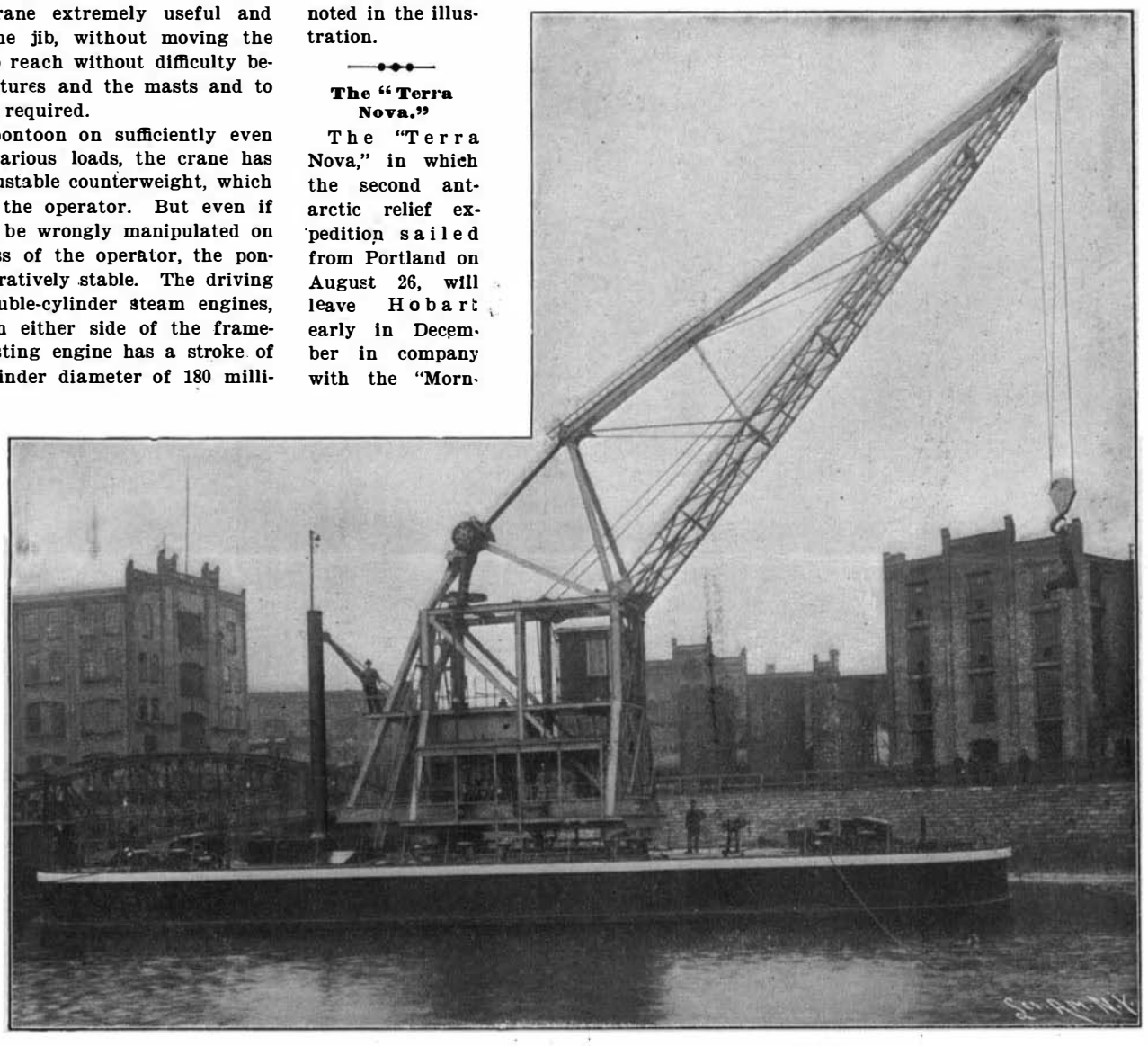
The crane was constructed at Duisburg by the Duisburger Maschinenbau-Actien-Gesellschaft, and is used for serving ships lying alongside the quay or in the floating dock.

This type of crane has many distinct advantages over the hammer cranes, with horizontal jib, and it is especially suitable for wharves where a full revolution of the crane of 360 degrees is not required, or is, in consequence of local conditions, impossible. Little space is taken up by the three-legged frame, and traffic on the dock is not disturbed or impeded in the least, while even locomotive cranes with large jibs may pass under the principal leg of the crane without difficulty when they are required for auxiliary service.

One of the advantages of this crane lies in the fact that it is provided with an adjustable jib, whereby the height of the ship to be served is of no consequence, as the masts are easily avoided, and any part of the ship between the masts may be reached. The crane is much lighter because of the absence of a counterweight, and the great height of the pulleys—45.25 meters with the jib drawn in—renders it possible to reach the highest parts of the ships, even if they lie in the dock.

When this crane is operated with a load of 150 tons, and at the highest projection of jib of 20 meters, the speed is 1.3 meters per minute; but with a load of 75 tons and the same projection the rate is increased to 2.6 meters per minute, or double the speed under full load. When the small hook is used with a load of 30 tons, the highest projection being 32.5 meters, the rate of operation is 6 meters per minute, and double this speed, or 12 meters per minute, is attained with a load of 10 tons.

The crane is worked by two double-cylinder steam engines, one of which drives the gear for lifting, the other transmitting the power for slewing, and altering the radius of the jib. The energy produced by slewing is mostly consumed by a friction clutch built into the shaft of the revolving gear, which excludes any compression on the frame or the driving gear. The crane is lighted by an electric arc light mounted on the top of the frame, as will be noted in the illustration.



A FLOATING 30-TON JIB CRANE IN HAMBURG HARBOR.

The "Terra Nova."

The "Terra Nova," in which the second antarctic relief expedition sailed from Portland on August 26, will leave Hobart early in December in company with the "Morning." The two ships will make their way south as swiftly as possible, and as soon as the "Discovery" is reached, active efforts will be made to blast her free of the ice, so that she can get away before the next cold season sets in. In case it is impossible to free the "Discovery," Capt. Scott and his men will be transferred to the "Terra Nova" and his ship left to be ground to pieces in the clutches of the antarctic ice, a lonely monument to the last great antarctic expedition.

The "Terra Nova" is the largest whaler afloat, and has been especially modified for ice work. She is built of oak strengthened with greenheart, and her bow is almost solid timber. Her total length is 187 feet, with a 31-foot beam. She was built eighteen years ago, and has engines of 120 horse power.

The famous Lincoln car, which has been in the possession of the Union Pacific Railroad for thirty-seven years, was sold recently to persons who will exhibit it at the St. Louis exposition. For many years the car has stood on a siding in the Union Pacific yards in Omaha, without attracting more than passing attention. It was part of the railroad exhibit at the Chicago and Omaha expositions. The car was built at the military shops at Alexandria, Va., in 1864, and was ironclad, armor being set between the inner and outer walls. It carried the remains of the martyred President to Springfield, and was then sold to the Union Pacific road.

The American Mining Congress.

The American Mining Congress recently held its sixth annual session at Deadwood, S. D. President Richards advocated the creation of a Department of Mines and Mining co-ordinate with the Department of Agriculture and the recently created Departments of Arts and Labor.

Secretary Shaw also spoke. He said in part:

"It is an error to rate the importance of our many industries according to their relative productiveness Our factories and workshops produced $13,000,000,000 gross in 1900; agriculture, $4,000,000,000; forestry, $2,000,000,000, and mines, $1,000,000,000, about equally divided between metallic and non-metallic products. Yet it must occur to all that manufacture—apparently our greatest wealth-producing industry—is dependent upon iron, copper, lead, and other metals, and equally upon coal and other non-metallic minerals. Our manufacturing interests would dwindle into insignificance but for our mines. Manufacture is equally dependent upon agriculture for cotton, flax, wool, and other products of the field and herd. Our commercial, industrial, and financial supremacy is, therefore, not dependent upon any one fact, or interest, or condition, but upon all combined.

"We produce practically 30,000,000 tons of iron ore—as much as any other two countries, and one-third of the world's output. We produce 40 per cent of the world's output of iron and steel. During the first half of 1903 we produced nearly 10,000,000 tons of pig iron. We produce more coal than Great Britain; more than twice as much as Germany, and nearly double that of all countries except Great Britain and Germany. We grow three-fourths of the world's cotton fiber, and our ability to produce this staple is far above the present product.

"A people's prosperity is not measured by its capacity to produce more than by its capacity to consume, and this capacity to consume is in turn dependent upon the earning capacity of the individual, and the earning capacity of the individual is again dependent upon native and acquired ability. So, if America be great, it is because God in His wisdom stored the mountains with the richest minerals, overlaid the valleys with a most fertile soil, and then gave it to people competent, in some slight degree at least, to improve their opportunities."

The Late Mr. Bishop's Costly Jade Book.

The personal estate of Heber R. Bishop included manuscripts on jade, which are to be published at an outlay of at least $75,000. The copies are to be limited to one hundred, and it is stipulated that they shall be distributed only to certain museums and libraries in this country and Europe.

Gallic Acid in Chinese Rhubarb.

E. Gilson states in Rev. Pharm. that gallic acid is present in Chinese rhubarb, both free and combined, together with cinnamic acid. He is also of the opinion that the tannin of rhubarb is not a simple body, as has been stated. He has separated from it three pure crystalline bodies which may be classed among the tannins; these comprise a glucoside, glucogallin, $C_{15}H_{10}O_{10}$, which is split up by hydrolysis into a molecule of glucose and of gallic acid; another glucoside of special interest, tetrarin, $C_{32}H_{32}O_{12}$, which by hydrolysis splits up into glucose, gallic acid, cinnamic acid; and a new substance, an aldehyde, rheosmin, $C_{10}H_{12}O_2$. This last occurs in long needles, which melt at 79.5 C., and has the strong characteristic odor of rhubarb. The fourth constituent of rhubarb, tannin, is a catechin.—Rev. Pharm.

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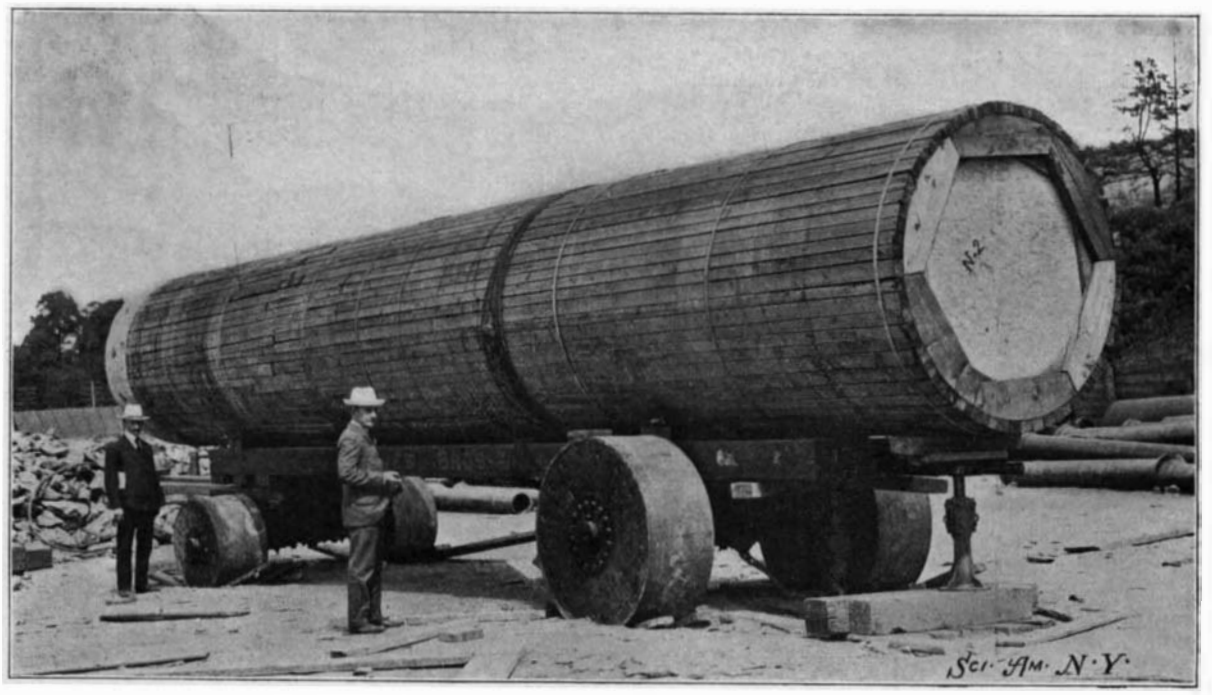
MOVING THE COLUMNS OF ST. JOHN THE DIVINE.

The Cathedral of St. John the Divine, Morningside Heights, New York city, is progressing slowly, largely owing to a lack of funds. Still, if unlimited money was at the control of the trustees, the enormous building could not be constructed in less than fifteen years. The eight great pillars for the choir have been completed and shipped to New York, and they are now being transported from the dock to the cathedral grounds. Each column is a memorial gift, and they cost about $25,000 each. It will be remembered that an enormous lathe was built to turn these columns. Unfortunately, they could not be true monoliths, as they broke in the lathe during the polishing operation, one of them fracturing within a few hours of completion. Therefore it became necessary to make the columns in two pieces. The larger section is 37 feet 6 inches in length by 6 feet in diameter, and weighs 90 tons. The smaller section is 17 feet long, 5 feet in diameter at the smaller end, and weighs from 40 to 45 tons. The material is granite, known as "Fox Island" granite. The columns were transported from Vinalhaven, Me., on the deck of a lighter, two columns being carried at one time; the smaller sections were placed in the hold. No very great difficulty was experienced in unloading the columns, a "timber hitch" and an inclined plane being used. In other words, a rope was roved around each of the larger sections of the columns, and this rope was then unwound by the aid of a powerful engine. As the rope left the columns, a rotary motion was imparted to them.

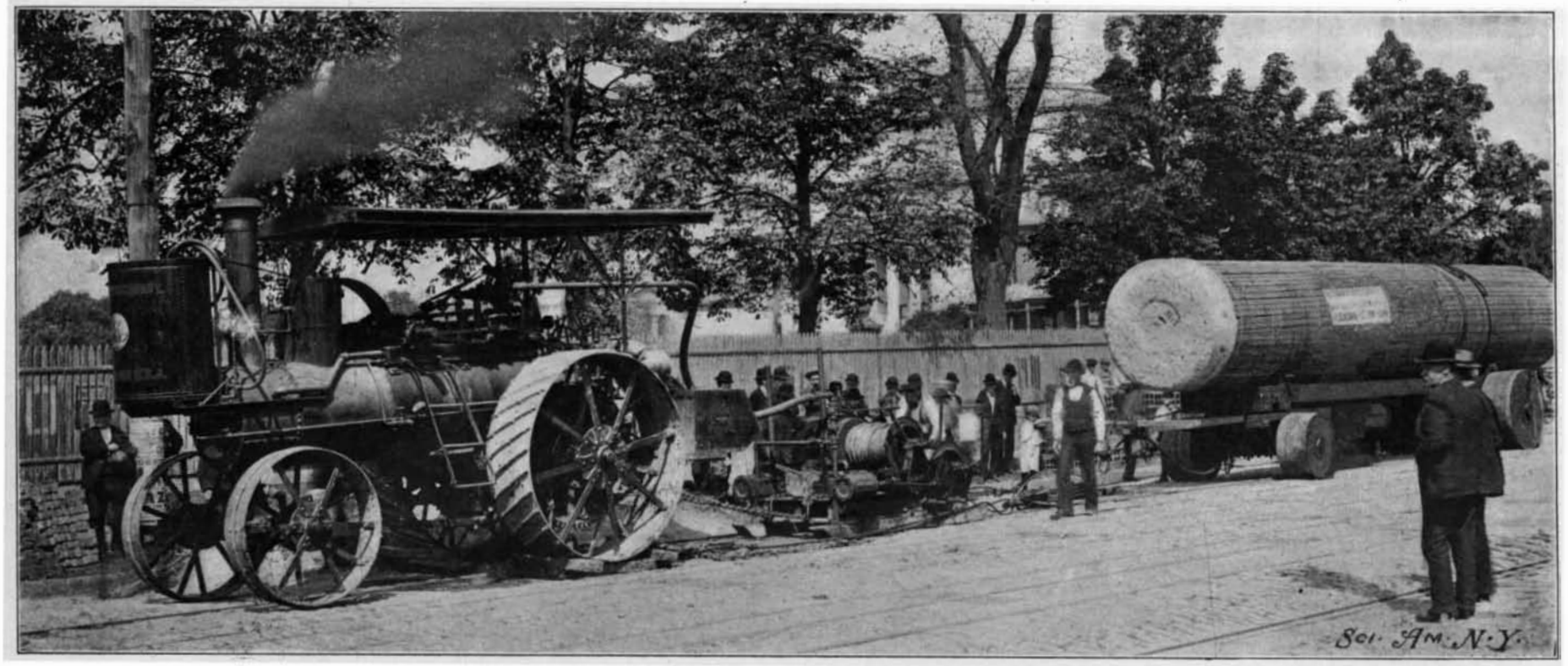
It then became necessary to carry the columns to the Cathedral grounds, which are situated almost two miles from the dock. A special truck was built for the purpose, which is one of the largest ever constructed. The frame of the truck is 30 feet long, and is composed of timbers 1 foot 2 inches by 1 foot and weighs 10 tons. The large wheels are 4 feet 3 inches in diameter; the small wheels are 2 feet 11 inches in diameter. The axles are 7 and 8 inches square and 8 feet 6 inches long, and are made out of cold-rolled steel. The wheels are built up of seven thicknesses of 3-inch white oak plank. There are four 5-inch tires on each wheel.

A 40-horsepower traction engine was used to transport the columns to the Cathedral grounds. The traction engine, however, did not do the actual moving. Some of the paving blocks were removed, and the wheels were allowed to rest in the cavities, taking the place of the usual "deadman" used by house movers. A powerful hoisting engine was connected with the shaft of the truck. This hoisting engine received its steam from the traction engine through a hose. After the column was moved a short distance, the traction engine and the hoisting engine were removed to the next anchorage. Progress was, of course, rather slow. It required nineteen days to carry the first column to the Cathedral. Strange to say, the contractors found that the steep hill which was encountered offered less difficulty than the level. It will be most interesting to watch the raising of the larger section and the superposition of the smaller piece. We are indebted to John Peirce, the general contractor for the columns, for courtesies in connection with the preparation of the present article.

Rear Wheel Embedding Itself in the Ground.



The Larger Section of the Column Jacked up Ready for the Start.



The Engine. The "Deadman." The Steam Winch. The column on its truck.

MOVING THE COLUMNS OF THE CATHEDRAL OF ST. JOHN THE DIVINE.—NINETEEN DAYS FROM WHARF TO CATHEDRAL.

Results of the "Suffren" Tests.

Very complete accounts have been published of the firing tests that were carried out by order of the French Navy Department against the turret of the battleship "Suffren," in the harbor of Brest, on August 18 last. A few additional particulars from an official source will, however, be read with interest. Two rounds were fired at the turret at a distance of 100 meters (328 feet), with the full service charges from a 12-inch gun, the heaviest caliber in use by the French Marine. Both projectiles were broken up against the turret, not only without damaging the armor-plates, but without causing any derangement of the turret mechanism. No serious shock was experienced, as was proved by the fact that the sheep placed within the turret were found to be absolutely uninjured and apparently unalarmed After the second round had been fired, the turret was worked electrically by the ordinary crew. All the movements for training in direction and height, as well as those operating the ammunition hoists, were found to be in absolutely good working order. The amount of current employed for working the turret and its accessories was exactly the same as was required before the experiments, a fact which showed that no derangement had taken place to cause increased friction. This is a very important result and appears to justify the decision of the French Admiralty in equipping all their modern ships with electric power instead of hydraulic. The Navy Department is also well satisfied with the results obtained, as proving the satisfactory form of construction, and excellence of material employed in the turrets, and it is considered that costly as the experiment was, the result obtained fully repaid the outlay. It is a matter of interest to note that the whole of the electrical installations of the "Suffren" turret were manufactured by Messrs. Sautter, Harlé & Cie., of Paris, and that their system is now officially adopted in the French Navy, as well as in the Russian Marine.—Engineer.

A contract has been closed for a new freight steamer for the Wolvin Syndicate, of Duluth, which will be the biggest boat on the lakes. The vessel will be built at the Lorain yard of the American Shipbuilding Company, and will be able to carry 10,000 tons of freight on 22 feet draft. She will be 560 feet long over all, 56 feet beam and 32 feet deep. There will be 33 hatches and it is expected that a full cargo of iron ore can be taken on in one hour and unloaded in four hours. The hull and the bulkheads will be so arranged that the unloaders can reach every part, and no shoveling will be needed. The engines will be quadruple expansion, with cylinders 18½, 23½, 42½ and 66 inches diameter, with 42 inches stroke. The boilers will be built to carry 225 pounds pressure.

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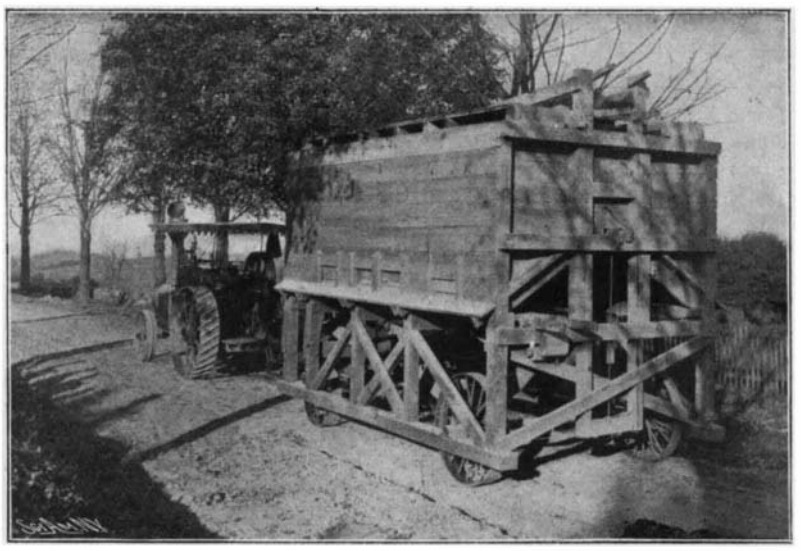
LAT ST PROGRESS IN GOOD ROADS CONSTRUCTION.

BY WALDON FAWCETT.

In few, if any, other fields of activity in America has the development of the past few years been comparable, in so far as rate of progression is concerned, with that which has taken place in the sphere of road building. Late progress in undertakings of this class is doubly interesting from the fact that the improvement is equally noticeable in two separate and distinct lines. On the one hand, there has been introduced machinery of greater power and efficiency, which has proven an influential factor in bettering the quality of the roads constructed, and at the same time has reduced the time involved for the operation. On the other hand, much has been accomplished in the evolution of methods to enable first-class road construction at a monetary expenditure lower than has heretofore been possible. The importance of this latter achievement will readily be appreciated, when it is understood that many of the sections of the United States most sorely in need of better roads embrace townships and counties where the value of land and the financial condition of the residents will not justify any heavy assessment upon the taxpayers.

One of the most important steps, from an economic standpoint, has been found in the invention of a road roller which is also a traction engine. A permanent good road cannot be made without the use of a steam roller, and yet the provision of such a machine, available for but one function, involves a rather heavy expenditure. The new combination outfits which have lately been introduced cost only about one-half as much as an ordinary roller, and by reason of the fact that the machines may, by the mere interchange of wheels, be converted from road rollers into traction engines, they can be used for the several purposes of operating the crusher, hauling stone to the road, and rolling the latter.

A machine such as has been described, when in use as a traction engine, will haul at least fifteen tons of stone over an ordinary road. When desired for use as a stationary engine in connection with a stone crusher, the simple unclutching of the driving gear insures its immovability, and power can be secured sufficient for crushing any ordinary rock. Another adjunct of the latest modern equipment for road making is found in a lately devised and very ingenious dump car, with an attachment for automatically spreading on the road any required thickness of stone or gravel. The stone is dumped from the crusher into the car, hauled to any desired point on the road by means of the roller-traction engine, and spread over the surface undergoing improvement much more evenly and rapidly, as well as much more cheaply, than would be possible by the use of men and teams. The dump car may be so adjusted that the sheet of crushed stone, gravel, or sand spread upon the road will be of any desired thickness from one to eight inches. An engine tender with sprinkling attachment fastened to the tank, for use in sprinkling during the rolling process, is also included in this equipment.



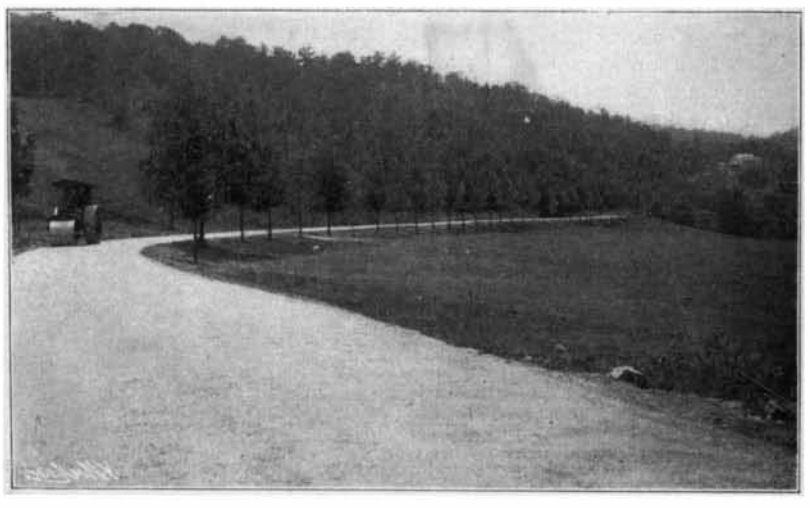
A Road-Making Machine.

Stationary Rock-Crusher

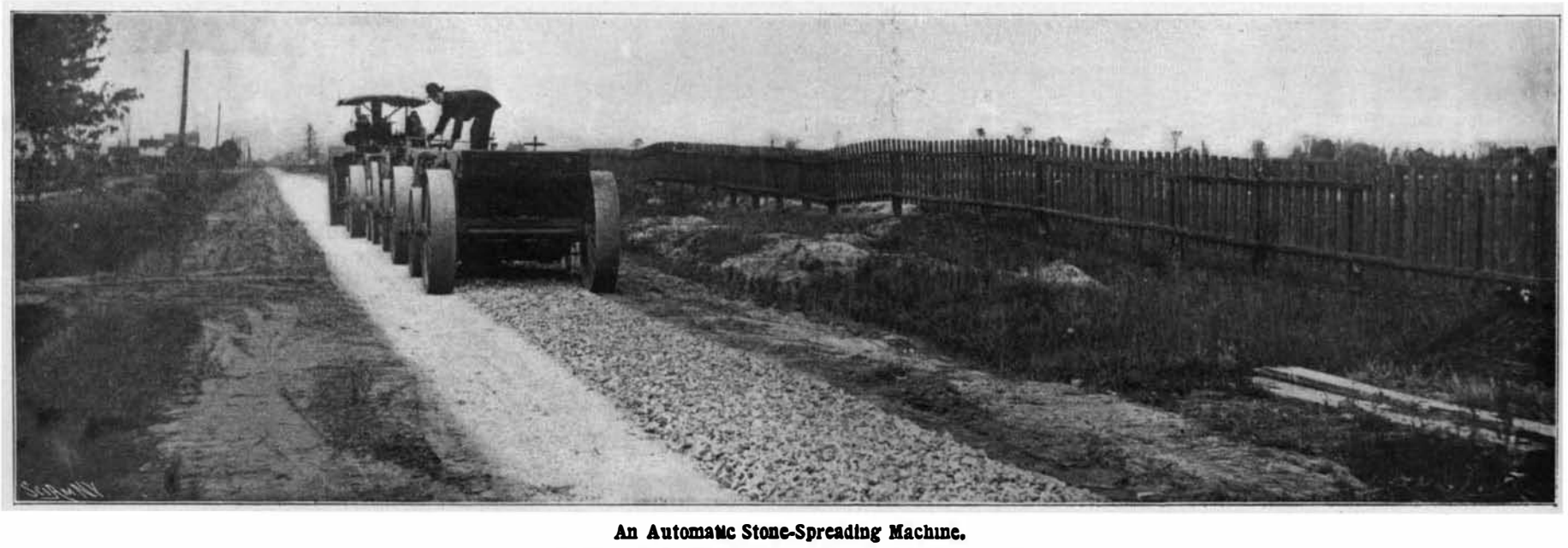
Notable advances have been made of late in the provision of complete portable rock-crushing outfits, including not only movable rock crushers, proper, but portable bins on wheels. The latest achievement in this line is found in the roller-bearing truck and folding elevator, in which steel castings for frame lever and jaw of crusher reduce the weight, and roller bearings for the truck wheels reduce the draft, so that a crusher having a capacity of fully twenty tons per hour may be transported with ease. Such an elevator raises the crushed stone fifteen feet from the ground, although the highest point when folded is less than ten feet.

The convenient and economical handling of stone in up-to-date road building demands not only crushers and elevators, but storage bins as well, so that the entire handling of the material may be accomplished without the use of manual labor from the time the stone is fed into the crusher until it is discharged into the wagon or cart. For small crushing plants the portable bin on wheels is now being used almost exclusively. It has a capacity of twelve tons, but when empty weighs but 3,500 pounds. It is made of seasoned lumber, the bottom being lined with steel and the stone discharged through automatic gates. It may be quickly attached to the elevator; in fact, the whole outfit, consisting of crusher, elevator, screen, and bin, may be set and ready for work inside of fifteen minutes. In such equipments the 30-inch revolving screen, preferably six feet in length, is usually used. When a larger storage capacity for crushed stone is required,

Road-Making at Hayward, Wis.



A Finished Road at Hot Springs, Va.



An Automatic Stone-Spreading Machine.

LATEST PROGRESS IN GOOD ROADS CONSTRUCTION.

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it is now customary to provide semi-portable bins or skids, ranging in capacity from 40 to 75 tons. These bins are fastened together by bolts, so that they may be quickly taken down for shipment.

Many improvements have been made during the past year in the wonderful dirt elevator, which plows up the earth and lifts the loosened material into wagons or conveys it to the center of the roadway. The dirt elevator consists chiefiy of an adjustable frame attached to the rear of the engine. Two rollers are provided, around which is placed a wide, 61-ply, endless canvas belt. The upper end of the frame, as now constructed, is susceptible of adjustment to suit the wagons or to enable the delivery of dirt to the best advantage in grading. When dirt is being delivered to the road grade, a distributing device at the upper end of the frame is utilized, which delivers the earth to any portion of the road desired.

The plow is attached to the axle of the engine, and thus delivers dirt directly to the lower end of the elevator. The adjustment of both plow and elevator is possible of quick accomplishment by means of levers. The latest models of dirt-elevating machine of the general type described are capable of handling from one hundred to one hundred and fifty cubic yards of dirt per hour, according to the soil handled and the total cost of maintenance and operation, with allowance for rental or interest on the investment, which seldom exceeds one cent a yard for the material handled. A recent innovation in this important branch of road-building practice is found in the introduction of special devices for transporting the roller attachment in separate loads over country bridges.

In the field of less pretentious road-building appliances, one of the most interesting productions of late years is found in the reversible steel road machine now coming into almost universal use. In the newest style machine the blade can be shifted outside the wheels on either side of the machine, and still retain its acute angles for cutting down banks and widening roads. The adjustment consists of a system of worm gears, which can be quickly manipulated by the operator while the machine is at work. The stay rod consists of a heavy steel bar, enabling the operator to force the blade in the bank without stopping his machine.

The axles may be extended on both sides of the machine quickly, and thus it is possible for the apparatus to take a cut from the side of the road and move it into the center of the highway without making it necessary for the machine to run over aught but a perfectly smooth surface. Other novelties which have lately been introduced in these machines with a view to contributing to efficiency and economy in road building, include a front lifting device by which the curvature of the moldboard can be changed without stopping the machine, thus preventing inconvenience when boggy conditions or clay or gumbo soils are encountered; a drawbar coupling with full cog circle, which permits the moldboard to be completely reversed should occasion require for the pulverizing of large lumps of earth that are thrown up in the center; and an improved compression spring in the forward end of the drawbar, which takes the sudden jar off the machine and the shoulders of the team, should the machine strike a fast stone or stump. The enhanced efficiency of present-day road-making machinery in general is to be attributed in no small degree to the fact that machines of various kinds are now tested in all kinds of soils before being placed in active service, and road construction is thus devoid of the experimental phase which has heretofore characterized it in each new locality in which it is undertaken.

A Curious Early Invention.

In the Mechanic's Magazine of London for December 7, 1839, may be found a patent carriage for descending hills, invented by Thomas Parkin. When the carriage arrived at the brow of a hill, having sufficient incline for the carriage to descend under the influence of gravity alone, the driver, by turning a crank, raised the horse entirely off his feet. The object was to be able to descend at a greater speed than would be possible if the horse had his feet on the ground. The following statement accompanied the description in the Mechanic's Magazine:

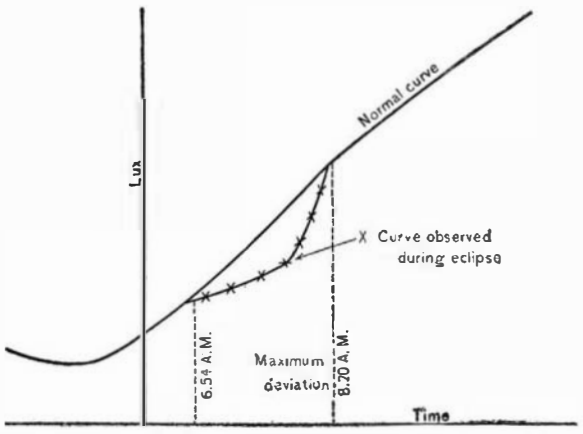
"Mr. Parkin states that he is aware that the lifting of a portion of the weight of a horse to ease his labor on descending hills has often heretofore been effected in carts by shifting the body of the cart backward on the axletree, and in other cases by taking a part of the loading from the front and placing it at the back of the cart; and also that a method of lifting a portion of the weight of a horse for the purpose of enabling him to increase his speed by striking the ground with his feet without pressing much of his weight on them, has already been made public; he therefore disclaims the partial lifting of a horse either on level roads or on declivities. But he claims the right of elevating the horse entirely off the ground on declivities down which the carriage can run by its own weight; this elevation of the horse being combined with a brake to regulate the speed of the descent, or to stop the progress of the vehicle, at any part of the declivity; and in combination also with the turning of the hinder axletree of the carriage to make it go in a curvilinear direction as above particularly described. He further claims the placing of the axletree and fore wheels forward, near or beyond the front of the carriage in this combination, by which the weight of the carriage is thrown so far behind the horses as to more than counterbalance them when suspended."

It would seem as though Mr. Parkin must have been accustomed to deal with very well-trained horses, or else have had an abiding faith in their good nature, for he makes no provision against the horses' kicking at being thus deprived of the use of their legs.

Howard A. Coombs.

A NEARLY TOTAL ECLIPSE OF THE MOON OBSERVED BY MEANS OF PHOTOELECTRIC SELENIUM CELLS.

Herr E. Ruhmer, the well-known experimenter in wireless telephony, some time ago put his selenium cells to quite a novel application, making some records



CURVE TAKEN WITH THE RUHMER CELL DURING ECLIPSE OF OCTOBER 31, 1902.

of a partial eclipse of the sun, which, on account of the heavy fogs prevailing, it would have been impossible to observe by a visual method. As, however, only 0.16 of the diameter of the sun was covered in Berlin on the 31st of October, 1902, only a slight departure from the normal curve of resistances could be recorded. Much more interesting results were therefore obtained with a nearly total eclipse of the moon on April 11-12 last.

Though the direct moonlight would have been quite sufficient to influence the most sensitive selenium cells. Ruhmer employed a parabolic mirror 45 centimeters in aperture in connection with a cylindrical selenium cell, the mirror concentrating the moonlight on the cell placed in its optical axis so as to produce a uniform illumination of the whole of the selenium cell. A small receiving apparatus, such as used to demonstrate optical telephony was then installed in connection with a small telescope, so as to be readily adjusted according to the position of the

RUHMER'S CELL APPLIED TO A PARABOLIC REFLECTOR FOR OBSERVING AN ECLIPSE OF THE MOON.

moon. After short-circuiting the parts shown in the engraving, the cell was connected to the circuit of a small measuring battery and a most sensitive milli-ampere-meter, allowing of hundredths of milliamperes being easily read.

The graphical record of the observed values of the current intensities obtained is interesting. Apart from some slight fluctuations due to transparent clouds passing before the moon, the character of the curve is of a striking regularity owing to the extreme clearness of the air that greatly facilitated the task of the observer. The luminous intensity and, accordingly, the intensity of the current was found to increase as far as 11 o'clock of the evening, owing to the increasing height of the moon, when, on account of the moon's coming in contact with the penumbra of the earth, both the luminous and current intensities begin to gradually (from 11 h. to 11 h. 37 m.) decrease, and, after the umbra of the earth is reached (11 h. 34 m.), fall rapidly. The time of astronomical maximum of the eclipse, as calculated, fairly coincides with the minimum of the curve. The second half of the curve shows the same features in a reversed direction, the final decrease being due to the eventual decrease in the height of the moon.

These experiments show the suitability of selenium cells for astronomical purposes. Herr Ruhmer has, moreover, devised automatically registering instruments, allowing of such phenomena being recorded with any degree of accuracy up to several hundreds of registrations per second. The telescope has only to be connected in a convenient way to a parabolic mirror with a photoelectric cell, the registering device being placed in any desired room of the observatory.

A. G.

Cleaning Air by Washing Instead of Filtering.

It has been demonstrated that much the larger share of trouble caused by imperfect contacts in switchboard connections in telephone exchanges can be prevented by proper ventilation of the operating rooms, and that implies thorough cleansing of the air entering them. Many experiments have been tried in the way of dry-cleaning by filtering through screens of wire and cheese-cloth or cotton-batting, but all such devices require frequent renewal, sometimes at considerable trouble and expense. By continued use any filter of this character must deteriorate and eventually become clogged, and in order to avoid the results of neglect it ought to be practically automatic. This point is essential in an air-cleaning system. In the case of one large telephone company very satisfactory results have been obtained by passing the air supply through a fine spray of water and afterward precipitating the moisture with the collected impurities and discharging it into the sewer. The water, which is taken up at high velocity and held in mechanical suspension, is extracted by centrifugal force by passing it through a series of tubes in which spirals are so placed as to give the air a whirling motion, causing the suspended particles, which are heavier than the air, to be thrown outward and brought in contact with the tubes, from which they flow through perforations to a drip-pan below. The washing process imparts about 70 per cent humidity at a temperature of 70 deg. Fahr. in the operating room. This is considered the most desirable for health and comfort, and avoids the excessive dryness sometimes resulting from other systems of heating, and ventilating. Moreover, in summer time, with the temperature outside at 80 deg. Fahr., and with the normal temperature of the city water, the air delivered to the rooms can be readily reduced to 70 deg. This is a supplementary advantage which must appeal at once to sufferers from extreme summer temperatures everywhere, and with the growing knowledge that such an advantage is available will undoubtedly come the insistence that buildings should be kept cool in one season as well as warm in another.—Cassier's Magazine.

The Current Supplement.

The opening article of the current Supplement, No. 1448, very exhaustively discusses the mining and manufacture of rock salt in New York State. Mr. W. P. Smythe's account of the North Sea fisheries is concluded. New types of machinery for making wagon wheels are described and illustrated. The much talked of fuel competition of the Automobile Club of France is a matter which will doubtless be of interest to our readers. An excellent article on a new form of friction-clutch by Prof. Hele-Shaw describes this most important piece of apparatus, both fully and clearly. Mr. D. A. Willey tells something of the modern craft of metal working, elucidating his text with some striking illustrations. A new type of car is now being used by the Illinois Central Railroad which promises to do much for the safe, rapid, and efficient transportation of its passenger traffic. Constructed as it is entirely of steel, the car could probably not be telescoped in a head-on collision. A full description of the construction of the car appears in the Supplement. Sir Norman Lockyer's remarkable presidential address before the British Association on "The Influence of Brain Power on History" is published in full.

A woman who lives on North 9th Street, Philadelphia, Pa., has started a rather novel school for the purpose of teaching parrots how to talk. Instead of straining her throat and consuming valuable time in repeating words for the parrots to practise on, the woman sets a phonograph going, retires to a rocking chair and takes it easy. The phonograph does all the teaching.

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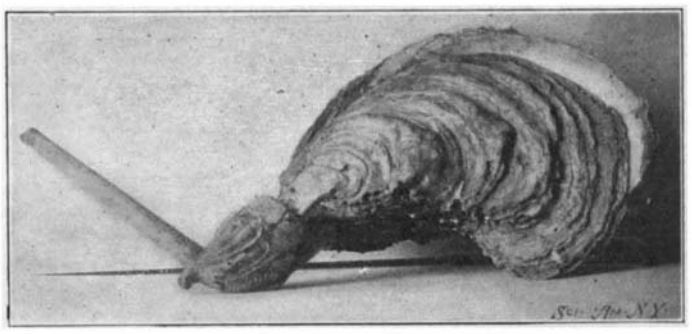
SOME CURIOUS OYSTER GROWTHS.

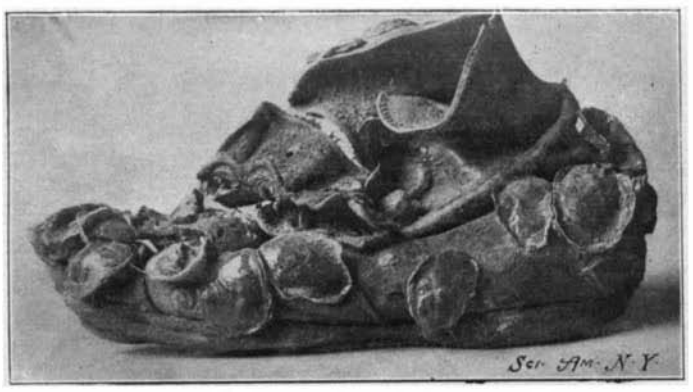
The accompanying illustrations show some of the vagaries of that most interesting of mollusks—the oyster. In the months of July and August, countless millions of young oysters are spawned and cast loose in the water upon the beds of bays, sounds, and rivers. Myriads of these young oysters fail to survive, and the probability is that, although from ten to sixty million young may be spawned by each bivalve, but a few individuals of these numerous millions find a suitable resting place on which to make their permanent abode, and are either lost in the mud or destroyed by the waves, to the mercy of which they are left by their parent.

One of the most important parts of oyster culture consists in supplying suitable materials for these young oysters—termed the "set" or "spat" in the parlance of the industry—to lodge and grow upon. Various materials, such as gravel, shells, crushed stone, and the like, are used for this purpose. In some places, in shallow water, brush has been effectively employed, and it has been found that a young oyster will attach itself to a small stick and grow quite readily with the latter embedded in its shell. Old oyster shells have, however, been found the most suitable for the purpose, since, by the time the oyster matures, the shells disintegrate. Consequently such old shells, dredged by hand from the oyster beds of past ages, and found embedded in the mud at the mouths of rivers, are generally made use of for the "set" to catch upon.

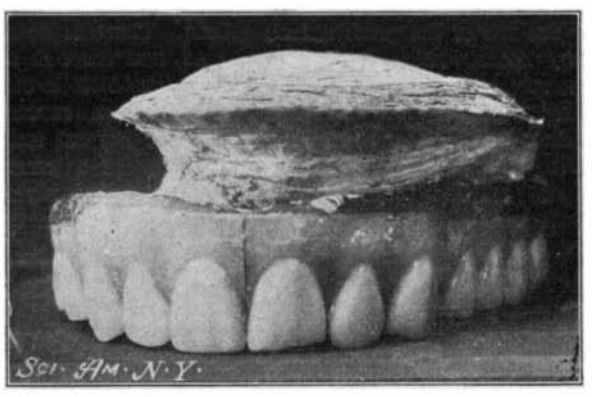
The proclivity of the oyster to make its home on anything that comes handy is very well shown in our illustrations, which were made from photographs of oyster curios in the possession of the United States Fish Commission at Washington. Undoubtedly the most curious instance of oyster lodgment is that showing a bivalve reposing on a set of false teeth. This particular set of teeth, which was dredged up from the bottom of Chesapeake Bay, has had several claimants since it was put on exhibition. The facility with which oysters attach themselves to leather is shown by the pictures of a child's shoe and an old boot, both very well covered; while the colony of these mollusks established upon an old lantern, shows how useful such objects may still be below the surface when their mission above it has been accomplished. From the bottle specimen, it would seem that as the young oysters grow and commence crowding each other, all but the few strongest-anchored ones lose their grip and are forced off by their mates. The oyster growing out of the bowl of an old clay pipe has the appearance of a puff of smoke just issuing, and is a veritable bit of nature's sculpture accomplished beneath the sea. The above are but a few of many interesting specimens of oyster-attachment dredged up from oyster beds, yet they give a complete demonstration of the readiness of this bivalve to attach itself to anything, and show, besides, some of the curiosities that are to be found beneath the surface of the water.



Oyster Fastened to a Pipe-bowl.



A Child's Shoe Covered With Oysters.

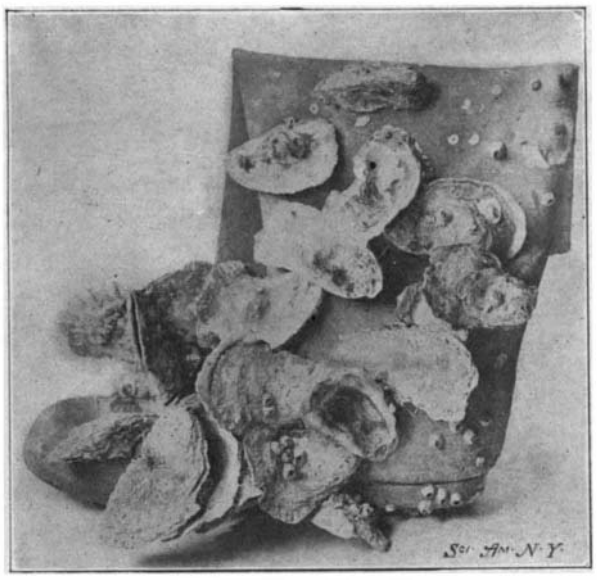


An Oyster Growing on a Set of False Teeth.

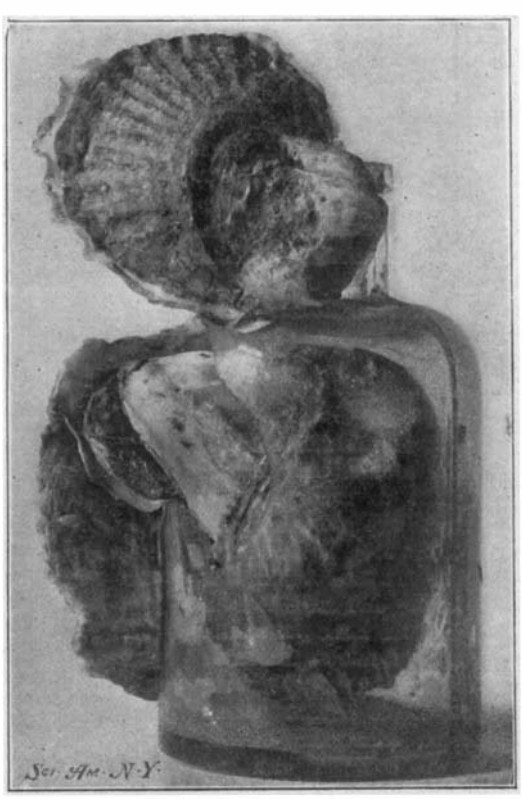
Sewage and Bacteria Beds.

At a recent meeting of the British Institute of Sanitary Engineers, held at Wolverhampton, England, a paper prepared by Dr. J. C. Thresh and Martin Priest, on the distribution of sewage on bacteria beds was the principal subject for discussion. The writers pointed out that it was now generally admitted that in the processes of sewage purification bacterial action was the most important factor with which they had to deal, and that the condition and quality of a sewage effluent would vary according to the different bacterial influences to which the sewage had been subjected. From the point of view of sewage purification, bacteria were divided into two classes, viz., anaërobies and aërobies, the anaërobies producing putrefaction fermentation, while the aërobies produced the true putrefaction, and it was the aërobiotic bacteria that they must chiefly endeavor to cultivate and employ in their sewage schemes. If bacterial treatment was the main factor in sewage purification, the proper utilization of the bacteria beds was the crux of the whole problem. The best means for the distribution of sewage on bacteria beds were: First, the so-called contact beds, in which the beds are filled with sewage, allowed to stand a certain time, then run off, and the beds allowed to aërate; second, distribution by means of alternating siphons, with or without arrangements for distributing the sewage over the whole surface of the beds; and, third, the continuous, or sprinkler system.

Many installations of the contact system for some reasons had not proved satisfactory. As regards aëration, the contact beds compared very unfavorably with the sprinkler bed; because, while the contact bed is alternately filled and emptied, the continuous, or sprinkler, bed worked under constant aërobiotic conditions, with always an ample supply of oxygen. In conclusion, the writers pointed out that the bacterial system of purification merely improved the sewage from a chemical standpoint, and left it nearly as impure as before from the bacteriological standpoint, and possibly, therefore, quite as dangerous, so far as disseminating germs of typhoid fever, cholera, and other water-borne diseases were concerned. Alderman Gibbons opened the discussion and stated that at Wolverhampton they dealt with an average flow of 2,500,000 gallons every twenty-four hours, and at times a much greater quantity. At the corporation sewage farm at Barnhurst they had had a tank working on the bacteria principle for thirty years, and Dr. Frankland, who had visited it, had said that the effluent was as pure as some of the water that was used for domestic purposes in London. Dr. Reid said the Wolverhampton sewage works would compare favorably with any in England, so far as results were concerned.



Oyster-Growth on a Boot.



Oysters Growing on a Bottle.

A Lantern Serving as a Hold for Barnacles and Oysters.

SOME CURIOUS OYSTER GROWTHS.

The Well in the Tower of London.

For ages antiquary after antiquary found himself baffled by a simple problem at the Tower. How, in the old days, did the garrison get a supply of drinking water? The antiquary could show you the original fireplace at which William the Conqueror warmed his hands, could point approximately to the spot on which the murdered Princes fell; he could lead you to the place where Henry VIII.'s queens were butchered, and to the tombstones that collapsed upon their poor bones; he knew the tiny dungeon in which Sir Walter Raleigh spent twelve dreadful years hidden from the light; and could have you in a twinkling in the stone dog-kennel where still remains the ring to which they chained Guy Fawkes. But how these unfortunates and their janitors drank, none could tell. The Thames hard by was not the source, they were sure. Organized search was vain. Then there came a thick-headed, unimaginative mason, to whom and his fellows the work of converting certain of the historic dungeons into storehouses for war material meant ninepence-halfpenny an hour and no more.

His pick struck through the flooring of the corridor from which the prisoners used to enter their cells. Behind these latter and corresponding with the main one, ran, and still remains, the little secret corridor along which eavesdropping officers tip-toed to listen to conversations between captives, for the purposes of evidence. A few blows from the pick brought to light the mouth of a pit. Sixty feet down was water—thirty feet of it. The mason had happened upon the historic well for which search had been made in vain for centuries! It was as perfect as the day that the Conqueror sunk it. Today it still carries its thirty feet of sweet spring water, and should ever the Tower be beleaguered, its garrison would still be independent of outside supply. We have our holy wells, our miracle-working wells, and wells of medicinal waters. If this historic old shaft which the mason brought to light were distant ten thousand miles, Londoners would make pilgrimages to drink its waters.—St. James's Gazette.

The Incandescent Mantle Company, of Detroit, Mich., is putting a mantle on the market which is said to have all the merits of the incandescent mantles now in use, with the additional advantage that it is much more substantial. While it is not indestructible, it is said to be the only one which can be handled without damage.

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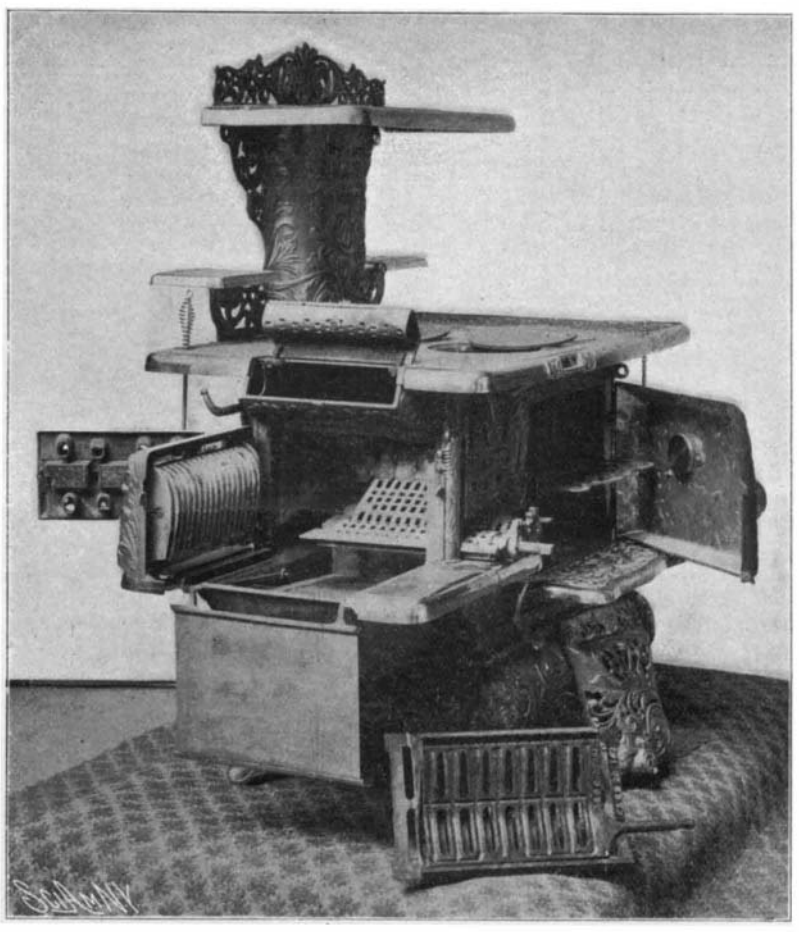
STOVE WITH AN ADJUSTABLE FIREBOX.

BY GEORGE J. JONES.

A great improvement in the construction of stoves has been recently made in a design just placed on the market, which has a number of novel features, the most notable of which is the adjustable firebox, by which the size and intensity of the fire can be regulated at all times. For instance, it is a waste of fuel to get up a fire capable of roasting a piece of meat when it is merely desired to cook a light meal for one or two persons. With the stove referred to it is possible to secure four different sizes of firebox, so that the size of the fire can be regulated to suit the emergency. This stove is made by the Cahoone Company, of Minneapolis, Minn., and a view of it is shown in the accompanying photographic view. The front of the grate is attached to the frame of the door and swings on a pivot, which is designated by the letter *A*. This grate is saucer-shaped, and when it is desired to get the full fire-box capacity, the bulge is turned outward, thereby increasing the capacity of the firebox by 156 inches. All ordinary purposes will be answered, it is said, by the use of the grate turned in. There is an auxiliary grate, which is put in place by removing the first row of covers in the back of the firebox and dropping it in with the use of a stove-lifter, and this confines the fire to one end, which is sufficient to answer a great many purposes. Then again there is a grate partition which is also dropped in place with the assistance of a stove-lifter, which confines the fire to the space under a single lid.

The latter attachment was designed for summer use, and with a mere handful of fuel required it is possible to cook chops or omelet or boil tea. Without this grate partition in place, maintaining the fire at one end of the firebox, it is possible to get the stove up to a fine baking heat.

Another feature of this stove is the fact that the air supply is delivered into the firebox superheated. In the picture, the casting has been removed from the front end of the firebox, showing the port holes for the admission of air. The air is carried from these holes through a series of chambers, and by the time it reaches the fire it is thoroughly heated. This greatly facilitates combustion, which is said to be so complete in this instance that there is no smoke or soot arising from the fire and the ashes show that the fuel has been thoroughly consumed. Garbage and other household waste can be thrown into the fire and will be consumed without the least odor. Bituminous coal burns beautifully without any objectionable features of any character. For this purpose a special grate is furnished, which is shown in the cut on the floor at the side of the stove.



STOVE WITH AN ADJUSTABLE FIREBOX.

The Mont Blanc Railway.

M. H. Duportal, the French Inspecteur Général des Ponts et Chaussées, has selected St. Gervais as the starting point for the railway which, it is hoped, in a few years will reach the summit of Mont Blanc. A line to the summit of the great White Mountain of Savoy has long been the dream of engineers, and at least three plans, devised previously to the accepted one of M. Duportal, have received serious consideration; but of these the only one which now occupies the attention of engineers is that identified with the name of M. Vallot, the Director of the Mont Blanc Observatory.

M. Vallot's project is a railway starting from Les Houches, opposite the present station of the P. L. M., a line which, after crossing the tremendous torrent of Le Bourgeat, enters a tunnel and continues practically subterranean throughout to the Petits Rochers Rouges, about 450 meters horizontal distance from the summit, and traced by way of the Gros-Bechar, the Aiguille du Gouter, and the Bosses, the total length being about eleven and one-half kilometers. The idea, here, seems to be to get the shortest possible and most sheltered line, enabling the summit to be reached in all seasons; and it is conceded that M. Vallot's survey is the best possible for the purpose.

M. Duportal's scheme does not supersede its predecessor, however; rather, it will prepare the way for it; and it has the great merit of serving the immediate and practical necessities of the district. The first section of the proposed electric line reaches the Aiguille du Gouter almost direct from Fayet by way of the Boinnassay Valley. The right side of this valley formed by the buttresses of the Prarion, of Mont Lachat, of Les Rognes, of the Tête Rousse, and of the Aiguille du Gouter, faces full south, and consequently is always free from snow early in the year, at any rate as far as the Tête Rousse. An open-air line by this route is therefore feasible; and this is important from the point of view of tourists, who naturally desire to see the marvelous perspectives of the mountains—which would be impossible if the line should be tunneled all the way. Moreover, it renders that beautiful upland called the Prarion available to all the world.—N. Y. Times.

A Curious Water Power.

We have been favored by one of our correspondents in Clarksville, Tenn., Mr. J. M. Macrae, with an interesting description of a curious water power which was made possible by the difference in level of the river, which has such a sinuous course that the two branches at one point are separated by a very narrow neck of land. The Elk River, in Franklin County, Tenn., furnishes power for lighting the towns of Tullahoma and Winchester, as well as for the waterworks at both places. At this point there is a bend in the river, the distance around being about one mile. At the point where the power house was built the width of the neck of land is but 30 feet, so that it was possible to see the two sections of the stream flowing in opposite directions. The bluff which divides the stream is about 40 feet high, and this isthmus is about 100 yards long. There is no room on the top of the bluff for a road, and there is only a footpath. At the narrowest point the bluff is cut through. A temporary dam was then thrown across the stream, turning the water through the cut and leaving the bed dry for the construction of a permanent dam, which is of concrete, and is 18 feet high and 10 feet wide at the bottom, while the width at the top is 4 feet. The concrete dam occupies the bed of the river, which is about 100 feet wide at this point. On a low bank opposite the power house an embankment was thrown up, joining with a wing of the dam. The power house is equipped with three turbines, which developed 300 horse power. The current is delivered to Winchester at a pressure of 2,000 volts, and to Tullahoma, 10 miles away, at a pressure of 10,000 volts, which is stepped down to 2,000 volts for consumption. The plant is the property of the town of Winchester, and the cost of the dam, machinery, wiring, water pipes, and tank was about $60,000. It will, of course, be remembered that during the civil war Gen. Butler cut off a circuitous water route on the James River, Va., by digging his famous "Dutch Gap" canal.

A parliamentary return issued on September 13 gives the amount of the trade of the British colonies and possessions with the mother country and foreign countries for the years from 1890 to 1900. In that period the imports into the British colonies from all countries increased by over £48,000,000; imports from the United Kingdom increased by £6,000,000; imports from colonies increased £13,000,000; and imports from foreign countries £29,000,000. In the same period the exports from British colonies to all countries increased by £51,000,000. Of this increase £22,500,000 went to the United Kingdom, £10,000,000 to British possessions, and £18 500.000 to foreign countries. In the year 1900 the trade done by the colonies with the United Kingdom and colonies was roughly £316,500,000, and the trade between the colonies and foreign countries £167,500,000. **The returns include bullion and specie.**

Lord Salisbury as a Man of Science.

With his characteristic modesty and retiring disposition Lord Salisbury never claimed to be a man of science, but all who listened to his presidential address "On the Unsolved Riddles of Science" delivered before the meeting of the British Association at Oxford in 1894, were deeply impressed with the comprehensive grasp which he had upon the development of science in all of its branches. On that occasion he certainly did not confine himself to a mere generalization of the scientific position; on the contrary, he alluded, and with a freedom which completely surprised those who devote their time almost exclusively to scientific study, to many of the minutest details in the problems which occupy the attention of the chemist, physicist, biologist, and astronomer. He discussed the foundation of the atomic theory, the nature and origin of the so-called elements, the spectroscope in its application to the study of solar and stellar phenomena, ether, and Hertzian waves, bacteriology, and the theory of natural selection, and did so with the confidence of one who knew his ground. This gave great conviction to his conclusion that the advances in each section of knowledge had been very great, while the hope of penetrating the prime mystery of all seemed as far off as ever. Lord Salisbury confessed to being pessimistic as to whether we should ever gain a clear insight into the nature and origin of life. It was characteristic of him, viewed in the light of his known mental attitude in other provinces, that he chose to survey the state of our ignorance rather than the proud position of our science. "We live," he said, "in a small bright oasis of knowledge surrounded on all sides by a vast unexplored region of impenetrable mystery, and from age to age the strenuous labor of successive generations wins a small strip from the desert and pushes forward the boundary of knowledge."

Lord Salisbury was reluctant to accept the views of the Darwinian school. He delighted in contrasting the deductions of the mathematician and geologist with those of the biologist upon the question of when life was first possible upon this planet.

It is generally understood that the branch of science which Lord Salisbury loved best was chemistry, and the freedom with which he discussed chemical questions gives weight to the suggestion. Besides, it was well known that he spent much time in his laboratory in Hatfield House, where, however, he directed his attention also to engineering and electrical problems. He conceived the idea of utilizing the flow of the river Lee for the electric lighting of the house, and the provision of a water-supply to the town of Hatfield from the mains of Hatfield Park was due to his thought and kindliness. In many ways he showed that his love of science had practical as well as academic leanings, but he made no original communication on scientific subjects to the learned societies. He was elected to the Fellowship of the Royal Society in 1869 and almost immediately became a member of the council. He took a keen and active interest in the internal affairs of the Royal Society, for he served on the council in 1882-83, and again in 1892-94. He was vice-president also in 1882-83 and in 1893-94. And almost his last public act was associated with science and not with politics, for on the occasion of the election of the Prince of Wales to the Fellowship of the Royal Society in April last it was Lord Salisbury who introduced him to the President and Fellows. Lord Salisbury's name is not associated with a single popular measure of the kind that would be sure to win medical approbation. But medical men could see in his attitude toward life the trained and austere thinker. He did not speak if he did not know; he would not proceed to the next step till he had verified the one on which progress should depend; and having convinced himself in which direction truth lay he would hold firmly to his convictions.—Lancet.

Spencer's Airship.

Spencer's airship sailed from Crystal Palace, Sydenham, around St. Paul's Cathedral and over miles of the densely-built part of South London. The airship descended safely after a fairly successful flight at New Barnet.

In 1901 there were 1,529 persons killed and 7,988 persons injured on the Russian railways. According to the mileage, there were on the State railways in European Russia 18.66 accidents to persons, on an average per 700,000 miles, 17.10 accidents on the private railways, and 14.52 cases on the state railways in Russia. The total injured was about one-fifth of the number injured in the United States every year and the total number of accidents is in about the same proportion.

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Sanitary Regulations of Barber Shops.

The last Legislature of New York State passed a sanitary code for the regulation of barber shops. The law has only recently taken effect. The Board of Health of New York has adopted the following rules in order to properly enforce the provisions of the State code. They are so reasonable and wise that we call attention to them with the hope that municipalities of other States where no such law prevails will demand the passage of similar legislation. The rules of the New York Board of Health are as follows:

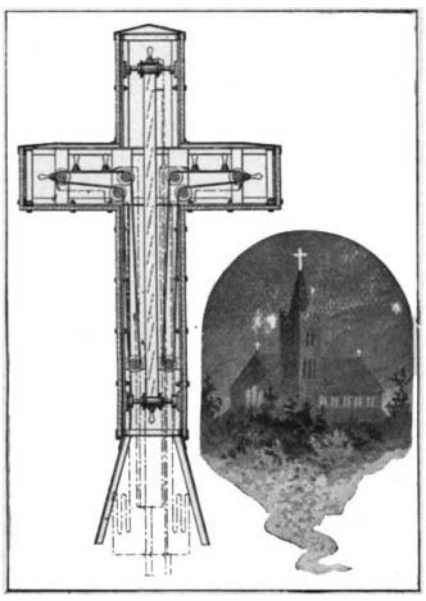
1. Barbers must wash hands thoroughly with soap and hot water before attending any person.
2. No alum or other astringent shall be used in stick form. If used at all to stop the flow of blood it must be applied in powder form.
3. The use of powder puffs is prohibited.
4. No towel shall be used for more than one person without being washed.
5. The use of sponges is prohibited.
6. Mugs and shaving brushes shall be thoroughly washed after use on each person.
7. Combs, razors, clippers, and scissors shall be thoroughly cleansed by dipping in boiling water or other germicide after every separate use thereof.
8. No barber, unless he is a licensed physician, shall prescribe for any skin disease.
9. Floors must be swept or mopped every day and all furniture and woodwork kept free from dust.
10. Hot and cold water must be provided.
11. A copy of the regulations is to be hung in a conspicuous place in each shop.

The most of these rules are now observed by every well-regulated barber shop, but the cheaper barber shops rarely pay attention to all the necessary sanitary precautions in serving their patrons. The evils arising from unsanitary barber shops have long been known, and we are glad to note the growing tendency to correct them.

ILLUMINATED CROSS FOR CHURCH TOWERS.

An illuminated cross at the top of a church steeple can be seen from a great distance and presents a very pleasing spectacle; but such illumination is seldom provided owing to the difficulty of reaching the lamps when they need repairs. The expense of hiring a "Steeple Jack" to replace a lamp whenever it burns out would obviously far outweigh the artistic benefits derived from such illumination. However, an invention recently patented by Joseph A. Blenke, of Covington, Ky., provides a very simple means of gaining access to the lamps. The means used will be comprehended by a glance at the accompanying illustrations. It will be observed that the incandescent electric lamps are mounted on belts which are stretched over pulleys. The vertical and two horizontal arms of the cross are each provided with a separate belt. The arrangement is such that the lowest pulley of each belt may be easily reached from the base of the cross. The lamps are inclosed in a glass case having the shape of a cross. The glass is preferably ground or frosted, so as to diffuse the light and distribute it more evenly in the form of a cross.

When for any reason it is desired to gain access to any one of the lamps the tower is ascended, and the

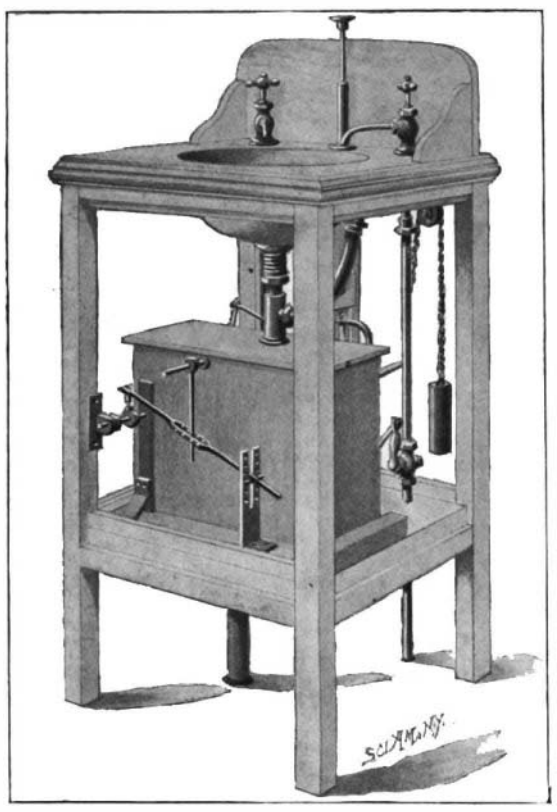


ILLUMINATED CROSS FOR CHURCH TOWERS.

belt on which the lamp is mounted may be reached through a door in the casing near the base. On pulling this belt the lamp will be drawn down to within reach of the hand. The wires through which the current is fed to the lamps have sufficient slack to permit the belt to be moved to a limited extent. After the lamp has received the necessary attention or been replaced by a new one, the series of lamps may be again returned to the normal position by drawing on the belt. All parts of the illuminated cross are thus rendered readily accessible to the electrician.

DEVICE FOR PREVENTING WASTE OF WATER.

Most sinks and basins are provided with outlets to prevent overflowing of the basin in case the water is left running by some careless individual. This precaution is good as far as it goes, but it does not prevent waste of the water, which, in some localities, is quite expensive. A recent invention, which is to be accredited to Mr. Warwick Ford, of 157 West 14th Street,



DEVICE FOR PREVENTING WASTE OF WATER.

New York city, is adapted to meet the requirements by providing means for shutting off the supply of water after the basin has been filled up to the overflow outlet. We show herewith a general view of the invention. The overflow pipe leads down from the basin into a small tank pivoted within a larger tank shown beneath the basin. The small tank is prevented from tipping forward by connection with a weight shown at the right in the illustration. Overflow water from the basin runs into the small tank until its weight causes the tank to tip and empty its contents into the larger tank, whence the water flows off through the waste pipe. Now, when the small tank swings downward the shaft to which it is secured is rocked, and this motion is utilized, by means of connecting levers, to turn the stop-cocks on the water-supply pipes, thus shutting off the flow of water. At the same time the stopper of the basin is lifted off its seat, permitting the water in the basin to flow out. When it is desired to use the basin again it is only necessary to push down the slide rod, which is shown between the faucets, and then lift it up again. This rotates the shaft, restoring the parts to their original positions. In order to empty the basin when no overflows occur, the slide rod is pushed down, which causes the main shaft to turn and lift the stopper off its seat. The main shaft may be seen projecting from the tank at the extreme left of our illustration. The crank arm on this shaft is connected to a rod resting at its forward end in a forked bracket. Midway of the rod is the slot into which an arm from the second shaft projects. By means of this connection rotation of the main shaft causes the second shaft to turn on its axis, and the relative amount of moisture can be regulated by raising or lowering the outer end of the connecting rod and by shifting the depending arm to different points in the slotted rod. The secondary shaft operates the stopper of the basin by means of a connecting rod passing up through the discharge pipe, and the adjustment just described is necessary to insure accurate seating of this stopper and perfect closure of the discharge pipe.

A System of Transporting Fruit Without Ice.

A car of Valencia late oranges of the Pet brand from Pomona, Cal., was recently shipped from San Dimas and packed by the Citrus union there, coming through under what is known as the Baker system of transportation.

The oranges were of poor quality and the packing the same. The fruit, however, opened in good condition, proving that fruit can be shipped from California without ice, under a proper system of treatment under some known process.

The Baker process consists in confining the food products in a dry atmosphere of medium temperature charged with a harmless, antiseptic, germicidal gas. The effect is claimed to destroy or make dormant the germs or bacteria, both in the atmosphere and on the food products, and by uniting with the exuded juices of such food products to form a germ-proof coating which not only excludes other germs or bacteria, but also prevents the further evaporation of the juices.

Progress in German Cable Laying.

A new era in German cable construction began with the laying of a cable to Vigo, Spain, a distance of about 1,300 miles.

During the last seven years, Germany has laid 7,375 miles of cable, at a cost of over $7,000,000. In 1898 a cable, 73 miles in length, was laid between Sassnitz and Trelleborg, and in 1899 German Southwest Africa was connected with the international telegraph system by a cable 154 miles long.

In 1900 the first German-American cable between Emden and New York, via the Azores—a distance of 4,813 miles—was laid. At about the same time Germany put down the first German cables along the Chinese coast, the cable Tsintau-Chefoo being 285 miles and that connecting Tsintau and Shanghai 438 miles long. The year 1901 witnessed the laying of the fifth cable between Germany and England, connecting Borkum and Baktou, a distance of 280 miles. The telephone cable between Fehmarn and Laaland was laid in 1902.

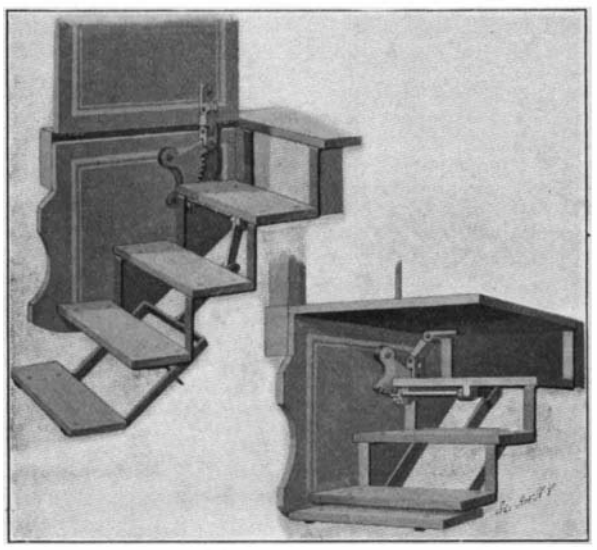
The construction of a second trans-Atlantic cable between Emden and New York, via the Azores, has been commenced and it will, it is expected, be ready for service before the expiration of the next year. Germany is also contemplating an increase of her cable net in eastern Asia and the South Sea, by constructing cables between Alenado and Guam and the Palau Islands and Shanghai.

It is said that the growth of German interests, both military and commercial, will in the future require the building of more cables by Germany, independent of foreign nations. Germany now has cable works and two cable steamers.

FOLDING STEP FOR VESTIBULE CARS.

Our columns recently contained a description of a folding step for railway cars, which could be lowered at stations to permit passengers to mount from or dismount to the low station platforms now almost universally used. The folding step was lowered or raised by means of a lever at the side of the car and was obviously much more convenient than the cricket or portable step which trainmen have heretofore been obliged to carry. The inventors of this step, Mr. James H. Fassett, of Nashua, and Mr. John E. Warren, of Greenfield, New Hampshire, have recently adapted their invention to vestibuled cars, and in doing so have hit upon an important improvement. In the present invention no lever is required for operating the step, but the same is automatically lowered and raised by connection with the hinged platform usually found on vestibuled cars.

The accompanying illustrations show the step in its two positions. The step, it will be observed, is carried on a forked arm which slides in a guide back of the fixed steps. At its upper end the arm is connected to a crank-arm on one end of a shaft. A gear-wheel is keyed to this shaft at the opposite end and meshes with a toothed sector connected by a link to the hinged platform of the car. Obviously, when the platform is



FOLDING STEP FOR VESTIBULE CARS.

raised, the sector will be drawn upward, rotating the gear-wheel and swinging the crank-arm downward, which throws the step out to proper position for use. When the platform is lowered the reverse takes place, and the step is drawn up to folded position beneath the lowest fixed step. In this way the supplementary step is operated without requiring attention of the trainman or causing him any more labor than the usual task of operating the platform.

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RECENTLY PATENTED INVENTIONS.

Electrical Apparatus.

TELEPHONE - TRANSMITTER. — DENNIS O'BRIEN, Limestone, N. Y. The principal object of this invention is to increase the loudness of sound in telephones while maintaining their purity. Mr. O'Brien's apparatus employs an elastic membrane in place of the usual diaphragm, on which is secured a thin iron disk which on being vibrated operates a delicate key of a local circuit. The apparatus has some of the functions of a relay and a repeater in that it reinforces the strength of an undulatory current.

Engineering Improvements.

PNEUMATIC WATERWORKS.—E. L. CANNON, Quitman, Ga. The invention relates to that form of pneumatic waterworks in which water is allowed to pass into a closed reservoir through a check valve and a body of compressed air in a separate tank is admitted to the top of the water to force it out of the reservoir through a standpipe. Mr. Cannon in this invention provides important improvements on such systems.

Lighting and Heating Apparatus.

STOVE.—WILLIAM HEVERMANN, Sedalia, Mo. A novel construction is provided in this invention whereby the stove secures maximum heating results by means of a circulation of air and by the introduction of drum sections and tubes. Conical or funnel-shaped centers of the drum section operate as reflectors for the purpose of throwing out the heat.

APPARATUS FOR BURNING HEAVY OILS. —F. COTTON, Sydney, N. S. W., Australia. The object of Mr. Cotton's invention is to combine a heavy residual oil with steam under pressure and subsequently vaporize the oil and decompose the steam so as to produce a highly combustible gas together with a continuous supply of oxygen and thus obviate the necessity for a forced draft.

OIL-STOVE.—J. L. BERGE, Minneapolis, Minn. The invention relates to certain novel improvements in oil-burning stoves. Mr. Berge has particularly in view as an object the provision of a stove which shall have an oil tank arranged compactly therein and a chamber or casing arranged above the tank and provided with passages to allow air to pass through the chamber, such air being heated in its passage.

Machines and Mechanical Devices.

MACHINE FOR OPENING AND CLEANING COTTON.—D. J. WINN, Sumter, S. C. Mr. Winn's invention consists in certain special arrangements of parts acting on the general principle of a cotton cleaning machine invented by Kitson, patent No. 144,394, but having important novel features which, after long experimentation and careful adjustment have been found to accomplish much more perfectly the objects desired.

FRONT-SHEET-DELIVERY APPARATUS FOR PRINTING PRESSES.—A. STOCKER, Des Moines, Iowa. Mr. Stocker is the inventor of an improvement in that class of apparatus which forms an attachment of printing-presses, and is adapted to receive the printed sheet from the impression-cylinder and deliver it upon a receiving-board. Two movable carriages are employed, also various adjunctive parts, and the invention lies in their construction, arrangement and combination.

GLUE-APPLYING MACHINE.—G. A. ENSIGN, Defiance, Ohio. The object of the invention is to provide a new glue-applying machine which is simple and durable in construction, very effective in operation and more especially designed for uniformly applying glue to the faces of disks or other similar articles preparatory to gluing them together.

Of Interest to Farmers.

AGRICULTURAL IMPLEMENT.—D. LUBIN, New York, N. Y. Two patents have been granted to Mr. Lubin for improvements in agricultural implements. The first invention provides in connection with an agricultural implement a simple means for regulating the depth of cut or drill of a machine. This is done by means of a weight which may be shifted along a rail at the top of a machine so as to weight the machine more heavily at the front end or the rear, as desired.

The second invention relates to improvements in agricultural implements of the kind having a plurality of sets of cultivating tines, the implement being so constructed that each set of tines will have an independent vertical movement under varying weight pressure, so that any one tine or set of tines will pass over an obstruction without lifting the other teeth or causing the machine to veer from a straight course.

Railways and Their Accessories.

RAILWAY-TIE AND RAIL-FASTENING.—P. H. QUINN, Corydon, Pa. Provision is made in this invention for securing rails to metallic railway ties. The ties have the form of channel iron and a peculiar key or wedge fastening is employed which secures the base portion of the rail to the tie. This fastening and tie provides a certain degree of elasticity whereby an advantage is obtained in wear and easy running of the rolling stock.

SPARK-ARRESTER.—F. E. ROGERS and E. HOSKING, Commercial Street, Mount Gambier, South Australia, Australia. The essential feature of the invention consists of the affixture of a rotatable screen within the funnel of the locomotive and so situated as to be acted on by the exhaust current. The screen is of such shape and proportions that nothing can pass between its edges and the funnel. The whole of the steam and gaseous products of combustion pass through the leaves of the screen, the sparks being deflected back into the smoke box.

GROUPED-INDICATOR FOR FREIGHT-CAR SYSTEMS.—E. B. JOHNS, Nashville, Tenn. The group system of handling freight consists of grouping each geographical station according to the station or city to which cars are loaded to break bulk. In this way hundreds of stations can be grouped under one head, which is obviously a great saving of labor to the receiving clerk in determining the proper route of shipment. Mr. Johns' invention relates to a group indicator board and attachment which will be found very useful in this system.

Miscellaneous.

TOILET-CABINET.—W. A. J. NEWELL, New York, N. Y. The invention is more especially designed for the use of actors, but applicable generally wherever an electric-light current is available; and it consists in the construction and arrangement of the parts of the case, the electric lights and their connections, and the combination and arrangement of these parts adapted to secure a better light and to secure in one structure an easily-portable case which may be entirely closed and carried or be opened and set up or disposed for use as a combined mirror-stand and cabinet.

INDEX-BOX.—J. A. BEST, Augusta, Ga. The invention is in the nature of a novel index-book by which the overflow of names from the alphabetical divisions allotted to them may be conveniently located and classified and accurately and quickly referred to and by which also the number of pages of an index may be greatly reduced without lessening the number of names to be indexed, securing the largest possible classification of names within an index of minimum size.

CUSHION-TREAD HORSESHOE. — A. A. SPADONE, New York, N. Y. Broadly speaking, the improvement consists of a cushion-tread having a body or length of rubber or other cushion material and a key or anchor embedded in the body or length, the key or anchor being of any desired cross-sectional shape and made of suitable material, which allows the key under the application of pressure to expand, spread or flatten in a way to make the body of cushion material hold itself frictionally within the channel of a shoe.

ANKLE-SUPPORTING SHOE.—A. POSNER, New York, N. Y. The object of the invention is to provide a new and improved ankle-supporting shoe more especially designed for the use of children and other persons and arranged to firmly support weak ankles, to insure perfect comfort, and allow of easily putting the shoe on or pulling it off.

FIRE-ESCAPE.—M. CODY, New York, N. Y. The object in this case is to provide a portable escape, readily placed in position on a building, provided with a convenient descending means, especially serviceable for supporting women, children, invalids, and other persons, and arranged to insure a safe descent from any floor of the building to the sidewalk.

ICE-FREEZING CAN.—E. E. HANMER, Richmond, Va. Provision is made in this invention for forming a cake of ice with lines of weakness and of admitting non-circulating brine to the interior of the ice-freezing can so as to prevent adherence of the cake to the can. A current of gaseous fluid is injected into the water to be frozen for the purpose of removing floating matter, which enables non-distilled water to be used. The can is so formed that the cake of ice may be withdrawn without trouble, after which it may be readily split along the lines of weakness.

TOY.—F. GARRECHT, Idaho City, Idaho. The toy belongs to that class wherein figures are adapted to descend from an elevation on a support and receive rocking movement from the joint action of gravity and the peculiar shape of the support along which they slide down. The present invention embodies novel details of construction which greatly improve such toys.

CRUPPER.—W. W. LYON and J. L. DAVIS, Mount Salem, Ky. The invention relates to that class of cruppers for harness in which the tail of the horse is supported and held in correct position, the object being to so support the tail as to add to the general appearance of the horse and at the same time prevent the tail from hanging to one side, causing it to maintain a central position.

FASTENER.—L. REITER, New York, N. Y. An improved socket part is herein provided for the stud and socket fasteners used on gloves, suspender ends, and in various other connections where two flexible parts are to be releasably connected. The socket part allows greater and easier movement to the resilient parts than in fasteners as heretofore made.

CEMENT-KILN.—S. R. MALONE, Quanah, Texas. The invention relates to kilns for drying gypsum and other materials employed in the manufacture of cement and plaster. Special advantages are derived by Mr. Malone's improved construction which consists of employing two ovens arranged side by side and communicating with each other. In treating wet gypsum both of the end fire boxes are used. With less wet gypsum the fire boxes at one end of the furnace will provide adequate heat. Thermometers located at proper positions indicate the necessity for more or less heat.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

A LOW-PRICED TYPEWRITER.

That it is not necessary to pay One Hundred Dollars for a high grade writing machine is demonstrated by the Sun Typewriter made by the Sun Typewriter Co., of 239 Broadway, New York. It is a type bar machine built on standard principles with modern improvements, and the writing is visible at all times. The machine is one of the best manifolders on the market, and there is no limit to the speed. A distinctive feature is the anti-ribbon inking mechanism which produces unapproachable writing exceeding in beauty and clearness any ribbon work.

The machine is compact, weighs only 13 lbs. and costs only $40. Their catalogue containing detailed illustrations and showing the various parts of the mechanism, can be had by addressing them.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 4623.—For first-class manufacturers of wax match-making machines.

For hoisting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 4624.—For makers of paint-grinding machinery.

AUTOS.—Duryea Power Co., Reading, Pa.

Inquiry No. 4625.—For a model for locomotive valve setting.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 4626.—For makers of wooden novelties, such as fruit and vegetable crates and baskets.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 4627.—For makers of screw cider presses in Michigan, Ohio and Indiana.

Mechanics' Tools and materials. Net price catalogue. Geo. S. Comstock, Mechanicsburg, Pa.

Inquiry No. 4628.—For the address of the makers of the Clement gasoline motor.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 4629.—For dealers in electrical apparatus and supplies for scientific experimental purposes.

Let me sell your patent. I have buyers waiting. Charles A. Scott, Granite Building, Rochester, N. Y.

Inquiry No. 4630.—For makers of a blower grain loader and unloader.

Machine Work of every description. Jobbing and repairing. The Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 4631.—For manufacturers of spring motors.

I have valuable lead and spar property in Illinois and want competent man to develop. Hegan Manufacturing Company, Louisville, Ky.

Inquiry No. 4632.—For a second-hand lathe for a country repair shop.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 4633.—For makers of patented articles for farmers' use.

Calvert's Perfect Ink Well Stand and Cover. Territory for sale or trade. Automatic dust proof air tight Patent No. 162,961. Calvert & Carson, Guthrie, Okla.

Inquiry No. 4634.—For a portable printing press for use in streets for printing visiting and business cards.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 4635.—For lights for examining bays, lakes, rivers, etc.

Contract manufacturers of hardware specialties, machinery, stampings, dies, tools, etc. Excellent marketing connections. Edmonds-Metzel Mfg. Co., Chicago.

Inquiry No. 4636.—For importers of Belgian shot guns.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 4637.—For a second-hand cedar row boat 17 or 18 feet long.

WANTED.—New novelties that are ready for the market. Must possess merit to justify extensive advertising in this and Foreign Countries. *What have you?* Wizard Novelty Co., Inc., 1007 Filbert Street, Philadelphia.

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☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway New York. Free on application.

Inquiry No. 4639.—For manufacturers of campo board.

Inquiry No. 4640.—For a maker of glass washbowl and stand in one piece.

Inquiry No. 4641.—For manufacturers of cut, polished and ready-to-mount gem stones, for rings, pins, charms, etc.

Inquiry No. 4642.—For manufacturers of gas arch lamps.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention **will be** paid thereto. This is for our information **and** not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9191) J. F. Du Q. says: 1. If I burn 100 pounds of anthracite coal, and get pure ashes without any cinders, what would be the weight of ashes, pulverized? 2. If I burn 100 pounds of wood, say shavings, what would be the weight of ashes pulverized? 3. If I burn 100 pounds of rag, what would be the weight of ashes pulverized? 4. If I burn 100 pounds of newspapers, what would be the weight of ashes, pulverized? 5. If I burn 100 pounds of leaf tobacco, what would be the weight of ashes, pulverized? A. From 100 pounds of anthracite the ash varies from 6-10 to 3 pounds, according to the particular kind of coal or the time. From 100 pounds of wood the ash varies from 48-100 pound from birch to 1.77 pounds from beech; and 31-100 pound from white pine. We have no data for rags and tobacco.

(9192) J. W. says: I have noticed or believe I have that incandescent electric lamps always burn out at either the positive or negative side, which I do not know. Now, if I should change the wires at the switch occasionally, say once a month, so that the direction of the current through the lamps is reversed, would not the life of the lamp be lengthened? If so, could you tell me how much, and if same is true with alternating current? A. The deterioration of the incandescent lamp is due to the projection of particles of carbon from the filament to the glass of the bulb. This blackens the bulb and decreases the cross section of the filament, so that its resistance is increased and less electricity flows through the lamp. We are not able to say whether this takes place at one pole more than the other or not, in a lamp lighted by the direct current. It could not affect the alternating current lamp, since this has no positive and negative poles. It would not appear that the difficulty would be remedied by reversing the connections. Should you wish to experiment in the matter and find out whether your theory is correct, it is easy to do so.

(9193) J. H. W. says: Will you please answer the following questions? 1. Why are four-cycle gas engines used in automobiles in preference to two-cycle? 2. Could not a two-cycle engine be built that would be perfectly reliable and give more power for less weight? 3. Which wire is proper to connect to the positive plate of a storage battery—the copper or zinc of a gravity battery? A. Four-cycle gas engines are used on automobiles because, in the present stage of gas engine development, the four cycle engine is the most certain and reliable. It may be possible in the future to build two-cycle engines which are equally reliable, but in the present stage of gas engine practice they apparently have not been sufficiently developed, and the automobile manufacturers evidently prefer reliability even at the price of increased weight for a given power. Connect the wire from the copper plate of the gravity cell to the positive pole of the storage cell for the purpose of discharging the storage cell with a gravity battery. The idea is to send the current for charging through the cell in the opposite direction from the current given by the cell in action.

(9194) McC. Mfg. Co. say: We have noticed your article on producer gas, and we would like to have further information about it. If we take a cast iron pot lined with fire-brick and having a suitable lid and piping, and put incandescent coal in the bottom, putting fresh coal on top, can we produce the gas by blowing air in at the bottom? Is it necessary to use steam, or is it done to keep the coal from burning too rapidly? A. In reply to your inquiry regarding producer gas, we beg to advise you that it would be possible for you to make a poor quality of gas which will be combustible, by taking a cast-iron pot lined with fire-brick, having a suitable lid and piping, and blowing air through a sufficiently thick bed of coal, as you suggest. The combustible elements in such a gas would be, first, the volatile hydrocarbons in the coal; and, second, the CO resulting from the imperfect combustion of the carbon. The calorific value of this gas would depend upon the quality of the coal that was used. All of the hydrocarbons would be present unconsumed, but all

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of the carbon in the coal would be burned to carbon monoxide, and would, therefore, have but about 70 per cent of the heat value that this carbon had originally. The other 30 per cent of the heat of the carbon in the coal would either be lost by radiation or would go toward raising the temperature of the resulting producer gas. The object of blowing steam with the air through the bed of coals is to utilize this heat and make it available in combustion later. The steam on coming in contact with the incandescent coal is decomposed, abstracting heat from the fire and setting free hydrogen gas, which is available for combustion later, and is present in the resulting gas in addition to all the other component gases that would otherwise be there.

(9195) W. B. M. asks: 1. What size wire is used to wind magnets on relays of 150 ohms resistance? A. Different sizes of wire are used by different makers in winding relays. With the ordinary spools you probably can wind 150 ohms by using No. 32 B. & S. wire. About 1-6 pound will be required. 2. How is the resistance reckoned or measured? A. The resistance of a wire is measured in various ways. The best way is by the use of a Wheatstone's bridge. The details of the method are given in Thompson's "Elementary Lessons." You can most easily obtain a resistance by the use of a table, such as is given in most catalogues of materials. 3. What is the difference between the B. & S. wire gage and the English wire gage? A. There is no rule for expressing the difference between the B. & S. and the English wire gages. The sizes have no common difference by which they can be reduced from one to the other. Number by number the English gage has larger wires. Thus 32 B. & S. is 0.00795 inch in diameter; 32 English, or Stubs, as it is called, is 0.009 inch in diameter.

(9196) C. C. R. asks: Please make out a list of uses for a small hand power dynamo of about 10 or 12 volts. When I close the circuit on my dynamo and turn it, it works hard. How can I remedy it? A. For the uses to which a small dynamo can be put see "Experimental Science" under Hand Power Dynamo. It will do anything which a battery of 10 cells will do. When the circuit of the machine is open, no current is flowing and the machine is doing no work. It therefore turns without difficulty. When the circuit is closed, it is doing work and requires work to turn it. You can remedy the difficulty by opening the circuit.

(9197) G. R. McD. asks: 1. Please inform me whether the voltmeter described in SUPPLEMENT 1215 when calibrated will have equal divisions throughout scale? A. The voltmeter will not probably have equal divisions throughout the entire scale under any arrangement. The difference will be slight, however. 2. Will the substitution of a metal spool for the cardboard spool make the instrument dead-beat? A. If a cylinder of iron is inserted into the coil as in the D'Arsonval instrument, it will become practically dead-beat.

(9198) C. W. D. says: 1. Is a storage battery suitable for electric lighting in a house where only a few lights would be used at a time? The object being to have a light at a moment's notice and at times when it would be inconvenient to run a dynamo. A. A storage battery is the most convenient way to obtain a few electric lights at a time when the generator is not running. 2. Could a satisfactory battery be built by an amateur or would it best be bought? A. It is not to be advised that any one should attempt to make a commercial storage battery for himself. The work requires machinery and experience not usually found in the shop of an amateur. The best forms are covered by patents. 3. About what per cent would be lost by a storage battery of energy? A. The per cent of loss varies. A large battery loses less than a small one. Perhaps you might realize 90 per cent of the charging energy. 4. Would the eight-light dynamo described in SUPPLEMENT No. 600 be suitable for charging such a battery? A. The eight-light dynamo will charge storage batteries. 5. Are all the high-speed gasoline motors satisfactory, and are they very durable with good care? A. Gasoline engines are reliable with good care. 6. Are storage batteries expensive to run after they are installed? A. Storage batteries increase the cost of lighting, since they deteriorate with use as everything else does. It is cheaper to light without transforming the current than to pass it through a storage battery.

(9199) F. S. says: 1. Can any storm originating in the West Indies be properly called a cyclone and improperly a hurricane? 2. What is the difference between a cyclone and a hurricane? 3. I understand the theory of storms is that all wind in motion takes a rotary action opposite to the movement of the hands of a watch. If this is true, are not all storms large or small cyclones? 4. In reading several authorities on the subject of storms, I concluded that a cyclone is more of a theory covering the movement of all storms rather than a distinctive feature of any particular storm. Is this correct? 5. Have the typhoon or simoon any phenomena different from the hurricane other than the locality in which they exist? A. We referred your questions to the Department of Agriculture, at Washington, D. C. The following is a copy of their reply:

"Referring to your inquiry regarding the definition of the terms 'cyclone,' 'hurricane,' etc., I beg to say that all storms in which the wind has a circulatory movement about a central area of low barometric pressure, may properly be termed cyclones. Tropical storms are known in the West Indies as hurricanes; in the Philippine Islands and on the southeastern coast of Asia, as typhoons; and in the Indian Ocean and Bay of Bengal, as cyclones. The general storms of the middle latitudes are usually referred to as simply storms, or areas of low barometric pressure. The 'simoon' is a desert wind, and is caused by the excessive heat of those regions. A tornado, or thunderstorm, is a secondary development that occurs within the areas of the general storms. In the northern hemisphere, the rotary motion of winds in storms is in a direction opposite to the movement of the hands of a watch, while in the southern hemisphere, the rotary movement is the same as that of the hands of a watch. This is true in the case of all storms, whether large or small.—H. E. Williams, Acting Chief U. S. Weather Bureau."

(9200) C. M. S. says: The article in your paper of recent date showing Lottie Brandon "looping the loop" has revived a discussion which we had a few months ago when she appeared in this city, and if it is not too "personal," I would be pleased to have it settled through your "queries" department. Professors and educated men claim that she can really obtain momentum as shown, while I say that the only momentum to start with is in the run of the wheels, and no matter how fast she pedals, her own weight and that of the bicycle frame have no momentum whatever to carry her around the loop, and it is doubtful to me whether she would be carried more than 4 or 5 feet on a level floor. She also makes two revolutions while men riding down the greatest incline can make but one. This again proves her "mechanical" loop. What are the laws governing the loop, and how could the diameter be determined, having given the velocity and weight of moving body, or *vice versa*? A. In reply to your inquiry regarding the principle governing the "loop," illustrated in the figure shown at the upper left-hand part of page 51 of our issue of July 18, we beg to offer you the following explanation: Before the rollers are lowered, allowing the wheels of the bicycle to come in contact with the loop, the *only* momentum is the momentum in the moving parts of the bicycle and the rider. The entire wheel, the chain or gears, the cranks and pedals, as well as the legs of the rider, have momentum, which is transformed into linear motion as soon as the wheels come in contact with the loop. The frame of the bicycle and the portions of the rider's body which do not move have no momentum as long as the machine stays on the rollers. The instant, however, that the bicycle and the rider commence to move around the loop, every part of the rider and the wheel has momentum proportional to its velocity. In compassing the first quarter of the loop, the rider, by vigorously pedaling, is able to very much add to the initial velocity which is given her by the rollers. During the upper part of the loop the pressure of the wheel against the track is so slight that it is doubtful if she is able to appreciably add to the store of energy which she and her wheel had at the quarter turn. It is the centrifugal force which holds the rider and her wheel against the track in opposition to the force of gravity. The centrifugal force is equal to $\frac{W v^2}{g r}$ where W is the weight of the moving body, g the acceleration due to gravity, v the velocity in feet per second, and r the radius in feet of the circle in which the center of gravity of the moving body turns. In order that the centrifugal force may be greater than the force of gravity, it is necessary that the velocity acquired divided by the radius r should be greater than 32.2. If the radius of the center of gravity of the rider and her wheel in this case is 8 feet, then the velocity at the top of the loop will have to be at least 16 feet per second. This corresponds to a velocity of about 11 miles per hour. In order that she may reach the top of the loop, however, and still have this velocity, it is necessary that she have a greater velocity at the quarter-turn point. Assuming that she is not able to do more than overcome the friction of the air and the friction of her machine, during the second quarter of the revolution, the necessary velocity at the first quarter point may be determined by the following rule:

$$v^2 = v_0^2 - 2g(h - h_0).$$

In this case $(h - h)$ equals 8 feet, the radius of the loop. The velocity v, therefore, equals 28 feet per second, which is equal to a velocity of approximately 19 miles an hour. If she has less velocity than this at the first quarter-turn, she will be unable to make an indefinite number of turns. The same would be true of a rider who acquired the initial velocity by riding down an incline. From the formula given above for the centrifugal force, you will see that the force tending to hold the wheel against the track is inversely proportional to the radius of the loop; hence you will see the advantage of having the loop small. The weight of the wheel and rider is absolutely immaterial, excepting so far as they influence the time that is needed to acquire the necessary initial velocity.

NEW BOOKS, ETC.

CHEMISTRY OF DYE-STUFFS. By Dr. Georg von Georgievics. Translated by Charles Salter. London: Scott, Greenwood & Co. New York: D. Van Nostrand Company. 1903. 8vo. Pp. 402. Price $4.50.

The aim in view was to provide a text book presenting to the student in as lucid and condensed a form as possible the extremely wide domain of the modern chemistry of dye-stuffs. In order to present to the student an accurate picture of the modern aspect of this branch of chemistry an endeavor has been made to clearly define the true importance attaching to the several dye-stuffs whether theoretically, practically, or historically. The practical application of the dyes is relegated to a companion volume.

TELEPHONY. Vols. I. and II. By Arthur Vaughan Abbott, C.E. In six volumes. New York. 1903. Vol. I., The location of Central Offices. Pp. 170. 33 illustrations. Vol. II., The Construction of Underground Conduits. Pp. 190, 62 illustrations. Price $1.50 each.

The telephone engineer is now an important factor in the electrical field. The rules for the location of "central" are very precise, and upon this may depend vast sums. The treatment of conduits is just as thorough. The draft of contract is admirable and certainly leaves little loophole for misunderstanding. This feature is worth many times the value of the book. We shall look with interest for the successive volumes.

CONTINUOUS CURRENT DYNAMOS AND MOTORS AND THEIR CONTROL. By W. R. Kelsey, B.S. London: The Technical Publishing Company. New York: D. Van Nostrand Company. 1903. 12mo. Pp. 440. Price $2.50.

Perhaps the features which differentiate this volume from similar works is the rather fuller treatment of electrical traction, so far as tramway-motors and their gear are concerned, and in the discussion of the flux-speed-torque. The work is illustrated by 225 engravings and diagrams. Its treatment is lucid and we can commend it to young electricians who have some knowledge of mathematics.

A SYSTEM OF PHONOSCRIPT AND PHONOTYPY. By Charles Morrell. 4th edition. Chicago: Phonic Institute. 16mo. Pp. 108. Price 25 cents.

LAVORI MARITTIMI ED IMPIANTI PORTUALI. Per Bastiani Flavio. Manuali Hoepli. Milan: Ulrico Hoepli. 1903. 18mo. Pp. 424. Price $1.50.

An admirable work dealing with all kinds of harbor work, docks, lighthouses, warehouses, dry docks, etc. There are now 800 of the remarkable *Manuali Hoepli*.

ELECTRICAL PRACTICE IN COLLIERIES. By Daniel Burns, M.I.M.E. London: Charles Griffin & Co. Philadelphia: J. B. Lippincott Company. 1903. 12mo. Pp. 224. 142 illustrations.

It is interesting to know that so much interest is being exhibited in the use of electricity in collieries, and in mines generally. Electricity lends itself readily to mine work, both for light and power. The book is an excellent one, even though we notice that it may serve as a guide to students who may be preparing for a certificate as mine managers.

RURAL SCHOOL AGRICULTURE. Exercises in Agriculture and Housekeeping for Rural Schools. By Willet M. Hays. St. Paul, Minn. n. d. 16mo. Pp. 199. Price 60 cents.

This book is worthy of wide circulation, and is badly needed. There are 237 exercises, all of a useful nature. The first exercise deals with the size of strawberry boxes, sharpening pocket knives, temperature of well water, pruning soft maples, and a host of other useful things follow. It interests even the casual reader.

THE ALTERNATING CURRENT TRANSFORMER. By F. G. Baum. New York: McGraw Publishing Company. 1903. 12mo. Pp. 195. Price $1.50.

A very important subject which has been somewhat neglected, except by the electrical press. It is hoped that the present work will be of use to engineers and the general student of electrical literature. Some knowledge of elementary alternating currents is presupposed.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

September 22, 1903,

AND EACH BEARING THAT DATE.

[See notes at end of list about copies of these patents.]

Adjustable holder, W. A. Dickinson	739,482
Air brake mechanism, J. Shourek	739,793
Air brake mechanism, T. J. Quirk, reissue	12,158
Air compressing apparatus, F. E. Bachman	739,472
Air compressor, L. M. Sartain	739,792
Album, toilet box, and writing desk, combined photograph, R. Aisenman	739,571
Animal leg brace, N. P. Allen	739,634
Automobile speed indicator, J. W. Sutton	739,740
Ax handle protector, J. C. Dalrymple	739,652
Axle box for vehicle wheels, T. Hill	739,415

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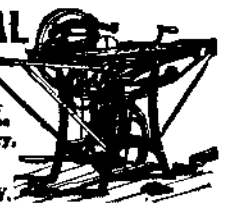
WOOD or METAL Workers



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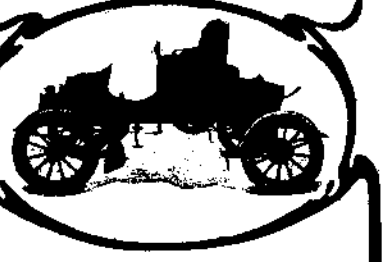

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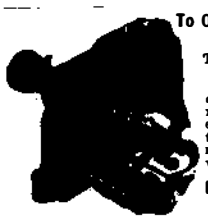

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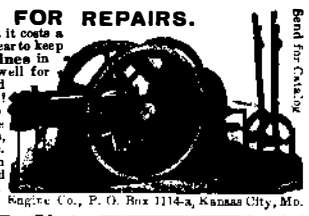

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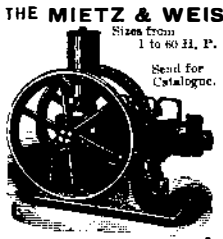

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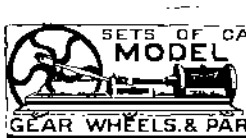

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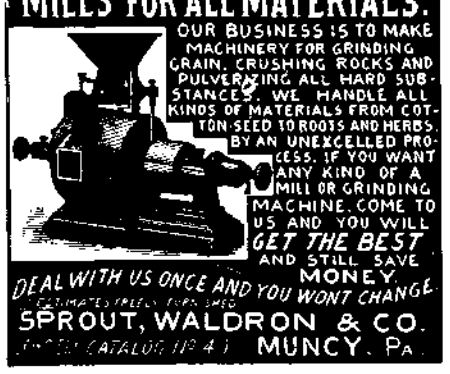

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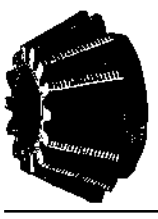

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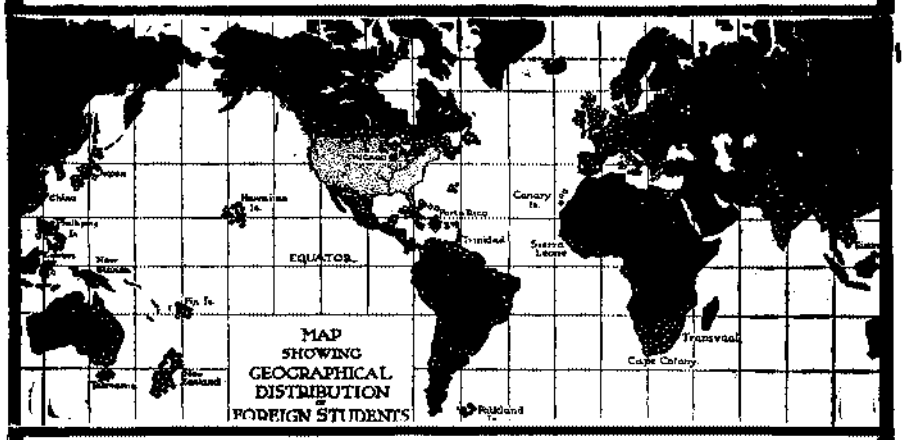

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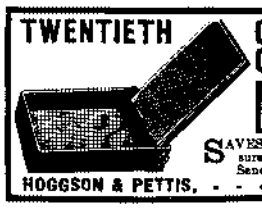

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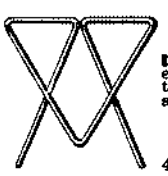

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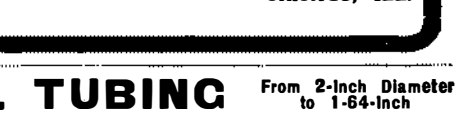

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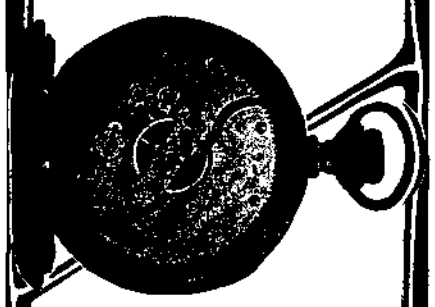

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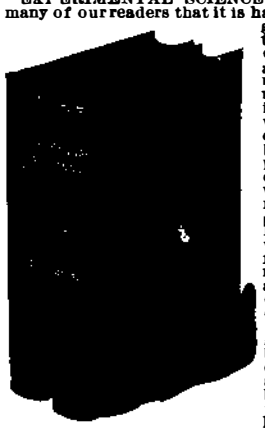

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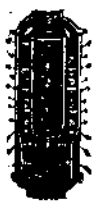

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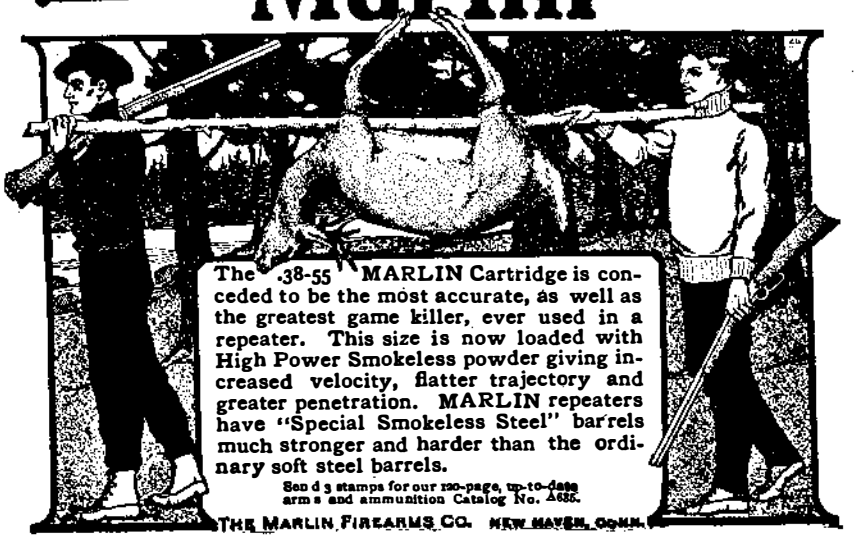
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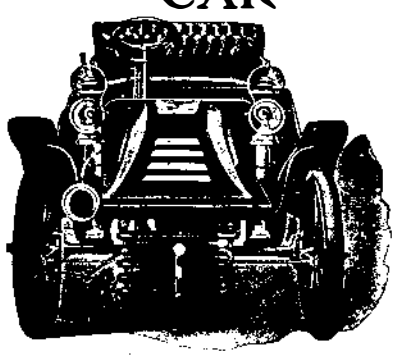

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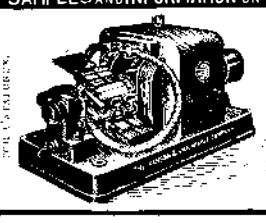

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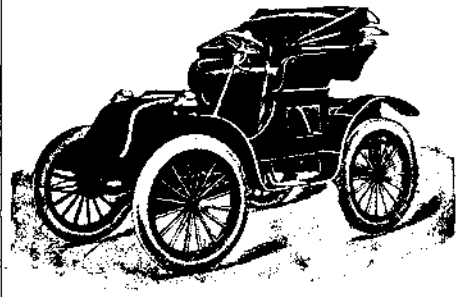

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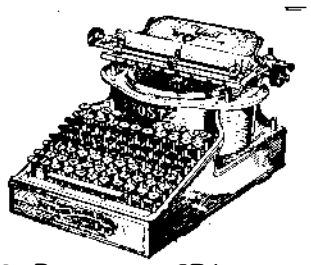

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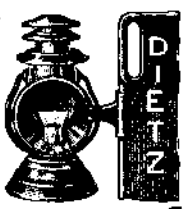

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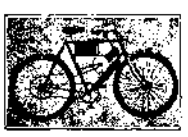

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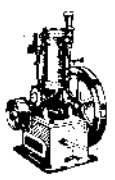

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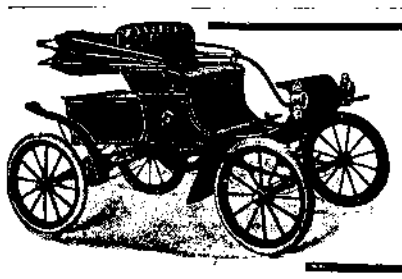

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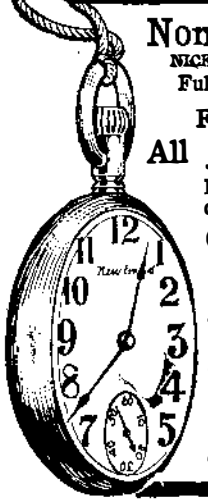

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